THE UNIVERSITY OF ALBERTA

A CASE STUDY OF A MATHEMATICS METHODS PROGRAM

BY

ARTHUR CRAIG LOEWEN

©

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF EDUCATION

DEPARTMENT OF SECONDARY EDUCATION

EDMONTON, ALBERTA
FALL 1987

Permission has been granted to the National Library of Canada to microfilm this thesis and to lend or sell copies of the film.

The author (copyright owner) has reserved other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without his/her written permission.

L'autorisation a été accordée à la Bibliothèque nationale du Canada de microfilmer cette thèse et de prêter ou de vendre des exemplaires du film.

L'auteur (titulaire du droit d'auteur) se réserve les autres droits de publication; ni la thèse ni de longs extraits de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation écrite.

ISBN 0-315-41105-8

THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR: Arthur Craig Loewen

TITLE OF THESIS: A Case Study of a Mathematics Methods Program

DEGREE: Master of Education

YEAR THIS DEGREE GRANTED: 1987

Permission is hereby granted to THE UNIVERSITY OF ALBERTA LIBRARY to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly or scientific research purposes only.

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

A Craig Loewen
(Signature)

639 - 16 St. South
(Permanent Address)

Lethbridge, Alberta T1J 3B3

Date: September 20, 1987

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled

A CASE STUDY OF A MATHEMATICS METHODS PROGRAM

submitted by Arthur Craig Loewen in partial fulfilment of the requirements for the degree of Master of Education.

Alton T. Olson
(Supervisor)

Andrea Borys

Jean H. Young

Date: August 12, 1987

This work is dedicated to:

Mrs. Olivia H. Slinn

and

Mr. David Loewen

ABSTRACT

This study was performed to answer these questions: What is the nature of the student teaching experience within the framework of the mathematics teaching methods program? What do student teachers consider to be indicative of successful and nonsuccessful teaching? What skills and knowledge transfer from the mathematics methods course to the classroom teaching experience?

The study was performed at the University of Alberta with twenty mathematics student teachers enrolled in the integrated professional term. These student teachers were enlisted to complete critical incidence forms during their student teaching practicums. Critical incidents were collected for two separate practicums, one each in the junior high and senior high. A total of 143 critical incidence forms were collected, 75 success critical incidence forms and 68 nonsuccess critical incidence forms. The critical incidents were grouped according to the types of incidents described, and frequencies were calculated. Interviews were conducted with the instructor of the mathematics methods course and with six of the student teachers. These interviews were used to determined the content of the mathematics methods course, and the degree to which the content presented in the mathematics methods course transfered to the teaching practicums.

It was found that: (1) student teachers tend not to be concerned with their students´ learning, but with being able to control discipline problems, being accepted as a teacher by their students, and being well prepared with complete lesson plans; (2) stress inhibits student teachers´ concern for their students´ learning; (3) student teachers tend to blame themselves for nonsuccessful teaching incidents but share the credit for successful teaching incidents with their students; and (4) the attributes most commonly identified as being necessary for successful teaching are mathematical knowledge, communication skills, preparation and organization, empathy, enthusiasm, and professionalism. Implications for the training of mathematics teachers were drawn from these data.

ACKNOWLEDGEMENT

The completion of a project such as this requires the assistance of many individuals...

-I would like to acknowledge the members of my committee who carefully reviewed this project and made positive, helpful suggestions. The members of this committee were Dr. A. Olson, Dr. A. Borys, and Dr. J. Young.

-A special thank you must be extended to Dr. Olson who, as the advisor for this project, spent many hours reading, consulting and providing me with insightful advice.

-I owe an immense debt of gratitude to Dr. Jones, Sheila, Anne, Susan, Bertrand, Troy, and Darren and to the other students of the mathematics education program who completed critical incidence forms.

-I would like to acknowledge Dr. Borys for her assistance in helping me formulate the original idea, sharing with me her knowledge of the critical incidence method of research, and steering me clear of certain pitfalls. This advice went a long way toward the expedient completion of this study.

-I would also like to acknowledge the interest and encouragement shown by Dr. Young and her willingness to serve as my external examiner.

-A special acknowledgement must be given to my parents who have supported and encouraged me throughout my studies.

-There are three people who helped in small ways, but the small things that they did were immensely appreciated. Thanks to Yvette M. d'Entremont for her assistance in coding the data, to Pamela S. Loewen for her help in creating the bar graphs, and to Teresa L. Loewen for her assistance in transcribing the taped interviews.

-Finally, gratitude must be expressed to Marla and Pepper whose contributions were intangible yet significant.

TABLE OF CONTENTS

CHAPTER PAGE

I. THE PROBLEM 1

II. PRESENTATION OF THE LITERATURE 8

Teacher Effectiveness 8

Teacher Education Programs 17

Mathematics Teacher Education 29

Student Teaching as a Developmental Stage . . 37

III. THE METHODOLOGY 45

Case Study 45

The Critical Incident Method 47

The Method 48

Coding the Data 53

Treatment of the Data 56

IV. PRESENTATION OF THE DATA 62

The Themes 62

Results from the Critical Incidence Forms . . 70

The Taped Interviews 84

V. INTERPRETATION OF THE DATA 85

The Mathematics Methods Course 86

The Student Teaching Experience 96

Differences Resulting from the Age of Student Taught 96

Gender Differences in Student Teaching . . 101

Differences Resulting from Prior Study . . 106

CHAPTER PAGE

Differences in Teaching Perceptions Occurring Over Time 112
Allocating Blame and Credit 118
Hearsay and Survival 123
Teaching Skills 128
The Interaction/Transfer 137
VI. FINDINGS AND IMPLICATIONS 146
Summary Statement 155
VII. REFLECTIONS 157
The Paradoxical World of the Student Teacher 157
The Role of Learning 163
Relative Influence of the Cooperating Teacher and Methods Course Instructor 166
Possible Further Research Questions 172
BIBLIOGRAPHY 175
RELATED READINGS 181
APPENDIX A. SUCCESS CRITICAL INCIDENCE FORM 185
APPENDIX B. RELEASE FORM 187
APPENDIX C. INTERVIEW QUESTIONS 188
APPENDIX D. INTERVIEW WITH ANNE 191
APPENDIX E. INTERVIEW WITH DR. JONES 215
APPENDIX F. SAMPLE CRITICAL INCIDENTS 235
APPENDIX G. COURSE OUTLINES 241

LIST OF TABLES

Table	Description	Page
1	Zeichner's Four Teacher Education Paradigms . .	19
2	Percentage Occurrence of Success and Nonsuccess Critical Incidents: Summary	74
3	Percentage Occurrence of Success and Nonsuccess Critical Incidents at the Junior High Level . .	75
4	Percentage Occurrence of Success and Nonsuccess Critical Incidents at the Senior High Level . .	76
5	Percentage Occurrence of Success and Nonsuccess Critical Incidents Reported by Females	77
6	Percentage Occurrence of Success and Nonsuccess Critical Incidents Reported by Males	78
7	Percentage Occurrence of Success and Nonsuccess Critical Incidents Reported by First Degree Student Teachers	79
8	Percentage Occurrence of Success and Nonsuccess Critical Incidents Reported by After Degree Student Teachers	80
9	Percentage Occurrence of Success and Nonsuccess Critical Incidents in the Early Term	81
10	Percentage Occurrence of Success and Nonsuccess Critical Incidents in the Middle Term	82
11	Percentage Occurrence of Success and Nonsuccess Critical Incidents in the Late Term	83

LIST OF FIGURES

Figure Page

1 The Three Phases of the Study 50

2 The Process of Becoming a Teacher 85

3 The Structure of the Integrated Professional Term 87

4 Structure of the EdCI 364 Course 88

5 Structure of the EdCI 365 Course 94

6 Percentage of Critical Incidents at each Stage Reported during the Junior High Practicum . . . 100

7 Percentage of Critical Incidents at each Stage Reported during the Senior High Practicum . . . 100

8 Comparison of Success Critical Incidents at each Stage Reported by Females and Males 105

9 Percentage of Critical Incidents at each Stage Reported by Females 105

10 Percentage of Critical Incidents at each Stage Reported by Males 105

11 Percentage of Critical Incidents at each Stage Reported by Students Completing a First Degree 111

12 Percentage of Critical Incidents at each Stage Reported by After Degree Students 111

13 Comparison of Success Critical Incidents Reported during Early, Middle and Late Time Periods 115

14 The Origin of the Survival Instinct in Student Teaching and its Effect on Concern for Student Learning 129

15 Discerning Between Theoretical and Practical . . 171

CHAPTER ONE

The Problem

The University of Alberta has a stage in its teacher education program which involves student teachers in teaching placements in local schools. These practicums are four weeks in duration, and the student teachers receive two such placements. The practicum placements are typically associated with six weeks of on-campus instruction in mathematics teaching methods. These on campus sessions are intended to provide students with an opportunity to learn the necessary classroom management, discipline, and general teaching skills so that they will become effective teachers. The student teaching experience is used as an opportunity to practice these methods. The purpose for jointly providing mathematics methods instruction and student teaching experiences *is* to encourage transfer of theory-based teaching methods to the classroom.

The purpose of this project was to examine a particular mathematics methods program (taught at the University of Alberta) and its associated student teaching practicum. The question which this study addressed was: What is the nature of the student teaching experience within the framework of the mathematics teaching methods program?

The major question can be broken down into two sub-questions, both of which contribute to an understanding of the student teaching experience.

First, what do student teachers consider to be indicative of successful and nonsuccessful teaching? Teaching effectiveness can be defined from many perspectives and by all of the participants in the schooling process. The experienced teacher views effective teaching differently than a first year teacher. The school administrator considers effective instruction as something different than does the mathematics pupil. Efforts to develop a single checklist of the criteria for effective instruction have been largely unsuccessful. The first stage of this study included a description of effective teaching as determined by student teachers through the critical incident methodology.

Another aspect of this first sub-question was what student teachers considered to be problematic while they were student teaching. There is evidence that suggests that different student teachers sense different types of problems during their teaching experiences. It is possible that: males identify different problematic issues than do females, that student teachers with previous degrees in Mathematics or Engineering experience different difficulties and successes than do first degree students, that student teachers working in the junior high school experience different needs than do their counterparts in the senior high school, and that student teachers express different concerns earlier in their practicums than they do later in their practicums. By considering and comparing all of these different experiences, we can better understand what preservice teachers view as problematic to student teaching. Furthermore, by considering the context in which student teachers identify problematic concerns, we may come to have a better understanding of student teaching, and the meanings student teachers ascribe to their experiences. What is the nature of the student teaching experience?

A second sub-question was: What skills transfer from the mathematics methods course instruction to the classroom teaching experience? What effect does the mathematics methods course have on the student teaching practicum? This sub-question linked the problematic issues of the student teaching experience (as described above) to the design and content of the mathematics methods course.

What the study was not attempting to consider is also important.

First, this study did not intend to actually implement and evaluate any recommendations which evolved. This study considered only the link between the mathematics methods course and the student teaching experience. This study was not an evaluation of the strategies whereby the link might be enhanced. The reader of the study, as an educator, must decide what does and what does not directly apply to his or her own situation, and implement that which might enhance his or her specific program.

Second, this study did not intend to ascertain the reasons and processes whereby perceptions of successful and nonsuccessful teaching were formulated. It would be interesting to know what historical conditions led student teachers to define effectiveness as they did; however, this would have required an in-depth study of the individuals who were participating in the study. Here we considered only their experiences as student teachers and the implications these experiences have for the mathematics methods course.

Third, this study did not consider all of the possible reasons why mathematics methods courses are taught. Several reasons may be identified, including: preparation for future teaching roles, a means to filter out students who have not achieved appropriate standards in personal and academic development, and provision of experiences in professional environments. This study was concerned only with the following rationale: mathematics methods courses are taught to help student teachers perform more effectively in their student teaching rounds and in their subsequent professional roles. The other possible reasons for these courses are no less worthy but were not considered in the design of this study.

Fourth, this study was not intended to serve as a means to evaluate the instructor, the University of Alberta or its staff, the cooperating teachers, the faculty consultants, the pupils in the schools, or the individual student teachers who provided the data. Mechanisms whereby such evaluations are achieved are already in place, and this study was in no way intended to replace or support them.

Within the context of this study certain key terms recurred and are defined below:

Preservice Mathematics Teacher: This person was a key informant for the study. He or she was either a third or fourth year undergraduate student at the University of Alberta, or was an after degree student returning to undergraduate studies to obtain a Bachelor of Education degree. He or she was a secondary mathematics education major and was enrolled in the Phase III semester (the semester that contains the student teaching practicum and mathematics education course).

Mathematics Methods Program: This program, under the structure established at the University of Alberta, contains five components: EdCI 364, EdCI 365, EdPR 354, EdPR 355, and EdPR 356. It is also known as the integrated professional term. This course entails two 4 week units of student teaching in mathematics classrooms. The first unit (EdPR 355) is traditionally a placement in a junior high school, while the second unit (EdPR 356) is in a senior high school. Accompanying these eight weeks of student teaching is approximately seven weeks of classroom instruction in mathematics methods broken into two sections. The first section (EdCI 364) precedes the junior high student teaching placement while the second section (EdCI 365) precedes the senior high practicum. The EdPR 354 course is an on-campus practicum. The exact nature of each of these five courses is discussed in Chapter Four.

Critical Incident: The researcher accepts Flanagan´s (1954) definition of a critical incident: "By an incident is meant any observable human activity that is sufficiently complete in itself to permit inferences and predictions to be made about the person performing the act" (p 327). In the case of this study, the inferences pertain to student teachers´ perceptions of what constituted successful and nonsuccessful student teaching.

CHAPTER TWO

Presentation of the Literature

The study of a mathematics methods program entails the study of four closely related fields. In order to give due consideration to each of these fields, relevant literature has been collected and summarized. These fields are: Teacher Effectiveness, Teacher Education, Mathematics Teacher Education, and Student Teaching as a Developmental Stage. One purpose of a mathematics methods program is the development of effective mathematics instructors, hence a review of teacher effectiveness literature. The mathematics methods course exists within the larger structures of teacher education and mathematics teacher education, and since student teaching has been recognized as a fundamental and practical portion of this educational strategy, it is presented as a developmental stage closely linked to mathematics methods instruction.

TEACHER EFFECTIVENESS

This study accepted that one purpose of methods courses in teacher training programs was the development of effective instructors. It thus became important to define effectiveness and how effectiveness could be measured. Due to the difficulty of this task, it was found that many studies were inconclusive or inconsistent with other research. What has been reported to date as well as concerns and criticisms of effectiveness criterion were summarized in the section below.

In trying to decide what an effective teacher is, first one must decide who should judge. Miron and Segal (1978) argued that students, as the recipients of teachers' endeavors, should be the sole evaluators of teacher effectiveness. Jones (1981) claimed that three possible judges exist: the student, the teacher (by way of self-evaluation), and external experts. Jones stated that it is unlikely that teachers could remain objective in the evaluation of their own instruction. He added that the opinion of external experts was not likely to impress students who do not concur with that opinion. By eliminating two of the three identified judges, Jones concurred with Miron and Segal.

Feldman (1976) and Hanna et al. (1983) reported observed biases in student evaluations. Feldman noted that students had a tendency to assign global high evaluations if a good initial impression was experienced or if other positive (though minimal or irrelevant) events occurred. This observation was called the 'halo effect' and is written about by other authors (see Feldman, p 265). Hanna, while trying to develop an evaluative instrument for supplying effective analysis of teacher quality, concluded that adjustments in students´ perceptions of teachers must be undertaken to account for the motivation level of students entering a course and the number of students in the class. These variables tended to bias students´ judgements.

Trafton (1980) and Suydam (1983) argued that the best tool for the evaluation of teacher quality is productive learning. It is argued that if teachers affect the amount of students´ learning, then the amount of learning must be indicative of teaching quality. Trafton was very direct in his statement:

> The quality of mathematics instruction is a major influence on how much mathematics students learn, how well they learn it and their ability to apply what is learned. Effective mathematics instruction, in other words, leads to productive learning (p 4).

Suydam was no less specific in claiming that effective instruction will be evidenced in high test scores. According to Jones (1981) in his study of university age students, the degree of student learning was primarily a function of the students´ desire to learn. Hence, even measures of student achievement and improvement may be misleading evaluative tools. These tools, regardless of their faults, are those that are employed in research and in the assessment of effective instruction.

The research in teacher effectiveness falls into two categories: teacher qualities and teaching qualities

(Trafton, 1980: Miron and Segal, 1978). Teacher qualities are those personal or personality characteristics specific to a given instructor, while teaching qualities are accepted as the actions inherent in the process of instruction.

Teacher qualities include dedication (Driscoll, 1986; Rubba and Becker, 1985), concern for students (Balka, 1986; Suydam, 1983), enthusiasm (Trafton, 1980; Feldman, 1976), as well as friendliness, helpfulness and openness (Feldman, 1976). Friendliness, helpfulness and openness were reported as characteristics students desired or preferred in instructors but not ones necessarily correlated to high student achievement (Feldman, 1976; Hativa, 1984). It is difficult to conceive of any teacher education program endeavoring to develop any of these characteristics in preservice teachers except by way of modelling. It has been reported that these characteristics bear little real relationship to effective instruction and hence to student learning (Grouws, 1985; Begle, 1979). Begle states:

> There are no experts who can distinguish the effective from the ineffective teacher merely on the basis of easily observable teacher characteristics... Evidently our attempts to improve mathematics education would not profit from further studies of teachers and their characteristics. Our efforts should be pointed in other directions (p 52-53).

Though his opinion is not shared by all, the fact that each researcher discovers different or contradicting teacher qualities gave credence to his argument. A much greater relationship appeared to exist between effective instruction and teaching characteristics (Driscoll, 1986).

Balka (1986) divided the characteristics of effective teaching into three non-distinct groups: affective, cognitive and managerial. Affective traits include the emotive aspects of teaching while cognitive traits relate to subject matter, and managerial qualities relate to classroom control (Balka, 1986). Affective traits could be considered personality traits or beliefs and values that are so broadly recognized as characteristic of effective instructors that they are considered teaching qualities as opposed to teacher qualities. This definition, though far from technically perfect, can provide crude guidelines in distinguishing between teacher traits and affective teaching qualities. Affective qualities include: politeness, acceptance, friendliness, encouragement and receptiveness to students' comments (Balka, 1986) and high expectations for student achievement (Good and Grouws, 1981; Suydam, 1983; Driscoll, 1986).

Cognitive traits are typically the traits stressed or targeted in teacher education programs. Cognitive traits deal primarily with knowledge and the presentation of subject matter. These characteristics have become the most commonly researched as they represent the traits students most commonly report as essential (Feldman, 1976; Hativa, 1984; Rubba and Becker, 1985; Balka, 1986). Specifically, these skills include: mastery of subject matter, lesson planning and structure, stimulation of student interest (Feldman, 1976; Miron and Segal, 1978), feedback and impartial evaluations (Feldman, 1976), appropriate tests, development of problem solving ability, use of good examples and illustrations (Hativa, 1984) as well as assignment of relevant homework (Rubba and Becker, 1985).

No two studies draw the same conclusions or rate the same characteristics as essential. This is probably due to the wide variety of study methods and sample groups. Clarity in presentation is one variable which was identified by almost all studies and papers, and was consistently one of the most preferred traits (Feldman, 1976; Miron and Segal, 1978; Suydam, 1983; Good and Grouws, 1981; Hativa, 1984; Balka, 1986). Hativa (1984) referred to Feldman's (1976) literature overview when she stated that studies which directly ask students' preferences in instruction, and studies that perform statistical analysis of student completed questionnaires, identified clarity as a prime student concern. "Both types of studies show that students attach primary importance to the methods of instruction--to the effectiveness with which teachers transmit knowledge to students" (Hativa, 1984, p 605). It is a student concensus that clarity in instruction is a primary concern. Clarity appears to be especially important in mathematics (Hativa, 1984).

Balka's (1986) final group of characteristics of good mathematics instruction included classroom management and organization skills. Other authors (Feldman, 1976; Hativa, 1984; Rubba and Becker, 1985; Driscoll, 1986) also identified these skills as indicative of quality teaching. The characteristics included in this grouping are: time on task is maximized (Roehler and Duffy, 1981; Good and Grouws, 1981; Suydam, 1983; Driscoll, 1986), teacher is well prepared (Feldman, 1976; Miron and Segal, 1978; Hativa, 1984), and teacher controls and minimizes behavior problems (Good and Grouws, 1981; Rubba and Becker, 1985). Although this list is not exhaustive, it provides an indication of the traits in this category. It is interesting to note that the teaching characteristics generally receiving the lowest importance ratings were subject matter research, teacher's external appearance, teacher flexibility (Miron and Segal, 1978), sense of humor (Miron and Segal, 1978; Hativa, 1984), teacher stimulated motivation, and interesting presentations (Hativa, 1984).

These lists and classifications of teacher and teaching qualities lend themselves to obvious criticisms as they provide very poor predictive measures of effective instructors (Begle, 1979). Will a teacher who possesses only some of these desirable characteristics be effective? If so, are there any traits which are essential? Are mathematics students rating characteristics according to personal preferences or according to the teacher characteristics which would afford them the greatest possibility for learning and success?

Perhaps the most severe criticism was phrased by Feldman (1976):

> ...Students' views of the ideal teacher, their listing of traits most important to good teaching, and their specifications of the characteristics of their best teachers are essentially descriptions rather than explanations...causal implications may still be unclear or ambiguous (p 265).

It becomes obvious that the reasons why mathematics students demand certain characteristics of their instructors is unknown. Understanding how students learn and why they learn the way they do, not just what students prefer, is the necessary knowledge that effective teachers and teacher educators must possess.

If the conditions and limitations of the above studies are accepted, then the findings may be summarized to a few generalizations: (1) The process of teaching is too complex and a function of too many variables to be easily reduced to a list of effectiveness characteristics (McQualter, 1986). (2) The expectations placed on mathematics instructors may differ from those placed on instructors in other disciplines (see Miron and Segal, 1978). Studies that derive such conclusions were performed at higher education levels where disciplines are separated, but such a luxury is not evidenced in most levels of secondary education. This fact may make the training of secondary education teachers more complex, for at the secondary level students of all backgrounds and interests are integrated. (3) Students are aware when teachers are not prepared and not organized. Teachers have an obligation to be prepared and competent to fulfill their instructional roles. (4) Students are task oriented and want a business-like approach to learning. They demand clarity, quick and effective resolution of discipline problems and little or no entertainment. The student is there to learn; the teacher is there to instruct. (5) Students want a well structured class and a knowledgeable instructor. Teachers are responsible for understanding the process of learning and being a facilitator of students' learning, and thus must have a thorough knowledge of their subject area.

Despite the arguments of Miron and Segal (1978) and Jones (1981), Placek (1983) and Placek and Dodds (in press) completed studies which used student teachers rather than pupils as informants. The first study, by Placek, was a field-based study in which four physical education teachers were observed for two weeks. Data were collected by means of lesson plans prepared by the informants, interviews, and observations. Placek looked for the variables that had the greatest impact on teacher planning. Placek reported that student behavior and 'environmental unpredictability' were the most significant factors. Placek dealt only with student behavior concerns and stated that the teachers were primarily concerned that students participated in activities, enjoyed these activities and behaved. Student learning was not a primary concern of the informants. Placek concluded that successful teaching occurred when students were busy, happy and good. Nonsuccess was not clearly defined.

The second study performed by Placek and Dodds (in press) employed the critical incident technique. The informants were 247 education students at the San Diego State University and the University of Massachusetts. Forty-six percent of the students were physical education majors, 34% were elementary education majors and the remaining 20% had other majors. Each informant provided written responses of critical teaching incidents which were later extracted, recorded on cards and grouped according to thematic similarity. Frequencies and percentages were calculated. The instances of nonsuccessful teaching, 383 in total, were recorded and grouped under five headings: student, teacher, learning task, environment, and prior conditions. The success instances, 508 in total, were collected and grouped under four headings: student, teacher, learning tasks, and environment. Placek and Dodds concluded that: (a) preservice teachers do not show marked change in their perception of success or nonsuccess in teaching while studying in teacher training programs, (b) evaluation of student teachers causes them to focus on keeping students busy, happy and good and not on student learning, and (c) student teachers see pupils as a source of blame for nonsuccessful instances, yet see themselves as responsible for successful incidents.

According to Trafton (1980), the teacher and teacher educator should respond in three ways: (1) Examine how students learn and the major components of effective instruction. (2) Examine one´s own teaching and look for areas of improvement using research findings as a model. (3) Recognize that learning is an expected outcome of instruction.

Thus far only the characteristics of effective instruction according to pupils and student teachers has been considered. The general concerns and processes of teacher education are also important in the study of mathematics teacher training.

TEACHER EDUCATION PROGRAMS

The training of mathematics teachers occurs within the larger framework of a general teacher education program. It is important then to consider the paradigms under which teacher education may occur, the common elements between these paradigms and the meaning of knowledge in education. The criticisms and issues which are faced by education programs are also faced by mathematics teacher education programs. These criticisms and issues serve to influence decisions made in mathematics teacher training and the development of curricula for such programs. Due to the inextricable link between mathematics teacher education and general teacher education programs, significant literature pertaining to the latter will be considered.

A teacher education program is founded upon a collection of ideals, values and beliefs, the sum of which is termed a paradigm. Zeichner (1983) defined a paradigm as

> ...a matrix of beliefs and assumptions about the nature and purposes of schooling, teaching, teachers and their education that gives shape to specific forms of practice in teacher education (p 3).

Zeichner proceeded to define four specific teacher education paradigms. The four paradigms are: behavioristic teacher education, personalistic teacher education, traditional-craft teacher education, and inquiry-oriented teacher education. The main precepts of each paradigm is summarized in Table 1 for comparative purposes.

The behavioristic teacher education paradigm is founded upon positivistic epistemology and behavioristic psychology. Its primary concern is the application of scientific research to student learning through effective and efficient instruction. It strives to discover patterns in the interactive behavior of the student and teacher in order to achieve maximal productive learning. Key words associated with this paradigm would include: technology, process-product considerations and means versus ends. The

TABLE 1
Zeichner´s Four Teacher Education Paradigms.

	Behavioristic	Personalistic
Foundations:	Positivistic Epistemology and Behavioristic Psychology	Phenomenological Epistemology and Developmental Psychology
Goal:	Development of specific and observable skills of teaching which are pupil related	Promote the psychological maturity of pre-service teachers--reorganize beliefs over mastery of specific behaviors, skills and content knowledge.
Educational Approach:	Stimulus-Response	Mastery Teaching
Curricular Knowledge:	Pre-specified	Derived according to teacher´s needs
Evaluation:	According to demonstration of specific skills	Achievement of self-actualized teacher
Preservice Teacher´s Role:	Passive recipient of knowledge	Evolving from Preservice teacher to professional, Definer of curriculum
Key Words:	Technology	Personal growth

Table 1 Continued

	Traditional-Craft	Inquiry-Oriented
Foundations:	Phenomenology	Praxis
Goal:	Teacher develops the skill of teaching through experience	Teacher becomes aware of actions and origins of actions
Educational Approach:	Trial and Error	Reflection and Action--Teacher Role is Problematic
Curricular Knowledge:	Determined by results of experimentation--experience with professionals	Determined by the process of praxis--Examine moral, ethical and political views--Skills to undergo critical inquiry
Evaluation:	According to demonstration of technical skills over time	Evidence of reflective action over time
Preservice Teacher's Role:	Passive recipient of knowledge from knowledgeable teacher	Active Agent
Key Words:	Craft, Skill	Liberation, Reflection-Action

behavioristic teacher will approach instruction with a stimulus-response methodology. The teacher education program for the behavioristic instructor views the preservice teacher as a passive recipient of prespecified knowledge. The teacher would be evaluated according to the observable employment of specific teaching techniques.

The personalistic teacher education paradigm, according to Zeichner, is founded upon phenomenological epistemology and developmental psychology. Other authors (Roehler and Duffy, 1981; Gage, 1984) would refer to the teacher trained under this paradigm as an artist. The artistic teacher is sensitive to the human condition and would strive to maintain high levels of creativity while meeting student needs and achieving the goals of individual instruction. Roehler and Duffy (1981) further describe the teacher as a facilitator to students' learning. This teacher provides planned instruction but then focuses on the student and spontaneously strives to respond to individual student needs. Gage (1984) introduces the notion of intuition and claims that the process of teaching cannot be reduced to a list of simple formulas but rather is a complex process often dependent upon teachers' instincts and sensitivities. Zeichner (1983) describes the goal of personalistic teacher education as the promotion of psychological maturity in preservice teachers as they reorganize beliefs regarding mastery learning. The preservice teacher should come to believe that every student can master specific behaviors, skills and content knowledge. Mastery teaching will be the approach encouraged in educational situations. Instruction in the implementation of manipulatives is consistent with this paradigm; student understanding is emphasized (see Young, 1983). The curriculum content of this teacher education paradigm is derived according to the needs of the preservice teacher and so is evaluated in terms of individual growth.

The development of the ′necessary′ skills in teaching is the goal of traditional-craft teacher education (Zeichner, 1983; see also Roehler and Duffy, 1981; Shulman, 1986). These skills are developed through interaction with an experienced teacher and through observational methods in a real environment. The preservice teacher is the passive recipient of a craft or skill from knowledgeable, professional teachers. Evaluation is completed over time through demonstration of acquired effective techniques. In order to provide maximum opportunity for trial and error experimentation, laboratory work could comprise a major component of methods classes in this paradigm. This approach allows preservice teachers to engage in active learning (Hawley, 1984) and creative thinking (Berliner, 1984) while developing desired skills.

The inquiry-oriented paradigm is the final teacher education paradigm defined by Zeichner. This paradigm is founded in the praxic structure of critical-reflective thought which results in action. In this paradigm the preservice teacher becomes aware of the origins of actions, and the teaching role is seen as problematic. The curriculum cannot be predetermined but evolves with the individual. The individual is seen as the active agent. Specific skills to be developed empower the preservice teacher to undergo the process of critical inquiry and action. Key words in this paradigm include reflective action and liberation. Issues confronted by these preservice teachers include: human survival through global interdependence, maximum realization of human potential, group and societal problem considerations, a proactive stance toward change, and the use and meaning of knowledge in the process of lifelong learning (Tafel, 1984). In this approach, preservice teachers must be involved in goal setting, understanding and examining the values of the program, recognizing subject matter as interdisciplinary and exploring the values needed for extended careers in education (Tafel, 1984).

No teacher education program exists entirely in one paradigm, most employ an eclectic approach. These programs and paradigms may be distinguished by analysis of their priorities (Zeichner, 1983). An understanding of these paradigms is essential for mathematics educators; it is within these diverse structures that the education and training of mathematics teachers is accomplished.

As the paradigms have been described by Zeichner, the differences between them are obvious. The characteristics which they share, however, are of interest as they highlight some of the major issues faced by teacher educators. These issues include: recognition of the necessity for a well defined endeavor, needed focus for teacher education programs, and the need for a clear and unique body of knowledge. The first issue represents the goals which teacher education programs strive to attain, the second issue explores the content which becomes the curriculum of the program, while the last issue identifies a body of knowledge upon which the previous issues may rest.

The four paradigms all endeavor to define a goal for teacher education programs. The process of teacher education must have a clearly specified objective in order that chosen essential skills and beliefs can be carefully developed and integrated into a useful framework. Greenberg (1983) states

> Teacher education is a fact--just like sex education--whether it's done on purpose, in an organized program, or not ...If teacher education is not done with reason, care and knowledge, it will be done through unexamined experience, innuendo, media blitz, untutored bias and chance (p 2).

Goals will undoubtedly vary between institutions, but the determination of the objectives that are to be met in mathematics teacher education programs and more specifically in mathematics methods courses must be completed. Educators may call for increased field experience (Queen and Gretes, 1982), improved academics (Lyons, 1980; Wisniewski, 1983), emphasis on decision making (Greenberg, 1983), and higher standards (Westerman, 1984). The task of the teacher educator is to clearly define the goals and the process of teacher education programs such that an appropriate focus may be derived, recognized and understood by other educators and by preservice teachers.

The focus of a teacher education program will be influenced by many factors. Zeichner (1983) identified some of these factors when he asked the following questions: Should the curriculum be determined in advance? On what basis? Does the curriculum reflect institutional form and social context? Should the curriculum influence the values, attitudes, underlying assumptions and constructs held by preservice teachers? What behaviors and attitudes should the curriculum attempt to influence? The paradigm from which the teacher education program is derived must be able to answer these questions.

In determining a focus for teacher education, one must consider the controversy regarding the relative importance of content and process in the education curriculum (Greenberg, 1983; Murray, 1982; Watts, 1982; Wisniewski, 1983; Westerman, 1984; Roth, 1984; Hawley, 1984; Joyce and Clift, 1984; Medlin, 1984; Shulman, 1986). Should teacher training programs create instructors proficient in teaching strategies and skills, or should preservice teachers be rigorous scholars of subject matter? Obviously an appropriate balance needs to be found such that teachers are masters of content knowledge and masters of essential instructional qualities (Freudenthal, 1977). A second, less controversial focus for teacher education considers the cognitive processes of teachers as dynamic decision makers in the classroom (House and Post, 1984). It can be argued that if teacher educators can identify and understand the cognitive processes experienced by teachers during decision making, then these teachers could be enabled to make better decisions. This would improve the classroom environment, students´ learning and the education process. Carpenter, Fennema and Peterson (1986) wrote:

> The research on teachers´ thought processes to date substantiates the view of the teacher as a reflective, thoughtful individual. Moreover, the research documents that teaching is a complex and cognitively demanding human process. Teachers´ beliefs, knowledge, judgments, thoughts, and decisions have a profound effect on the way they teach as well as on students´ learning in their classrooms (p 226).

Both issues, knowledge of instructional process and curriculum content mastery, are of concern for the teacher educator as either (or both together) could provide focus for a teacher education program.

A third issue which arises from Zeichner´s four paradigms is the identification of a unique body of knowledge. A major criticism of teacher education programs has been that they have failed to identify a solid knowledge base (Watts, 1982; Roth, 1984). The advocates of this criticism have argued that effective teachers need only be thoroughly trained in a subject area as any other applicable skills can be developed when necessary. They argued that there is nothing that studies in education provide which make an individual a better teacher. In some American states this has led to the certification of teachers who have little or no training in pedagogy. One author (Watts, 1982) claimed that until a definable body of knowledge is identified, teaching cannot be a true profession; there is no other profession that does not research, defend, and act upon a defined knowledge base. Shulman (1986) attempted to deal with this difficulty by defining three categories of knowledge within the educational field: subject matter, pedagogical knowledge, and curricular knowledge.

Content knowledge is the collection of facts and concepts of a domain of study along with interrelational structures which give the domain meaning (Shulman, 1986). Lyons (1980) extensively criticized teacher education programs for graduating content illiterate students. Several authors (Hawley, 1984; Joyce and Clift, 1984; Medlin, 1984; Shulman, 1986) exhort teacher educators to be more strict in this regard and call for tougher accreditation standards. Content knowledge is not the mandate of the field of education, in fact it is at present primarily controlled by other university faculties.

The second category of knowledge is pedagogical content knowledge, how learning occurs. How do students learn? Under what conditions do students learn best? How can teachers illicit the best learning in their students? This category of knowledge deals with the preparation of content knowledge for learning by selecting the best examples, illustrations, explanations and demonstrations to expedite the process of learning by making the content knowledge understandable to others (Shulman, 1986). This second category also includes understanding what makes a topic easy or difficult to learn. Thus the closest link between research in learning and teaching and the classroom situation exists in pedagogical content knowledge (Shulman, 1986). This is one promising area in which education may distinguish itself as possessing a unique body of knowledge.

The final category of knowledge is curricular knowledge. Curricular knowledge pertains to the selection of materials which will facilitate the use of the previous two forms of knowledge. The teacher should be aware of the range of possibilities for the learning process; one possibility is not sufficient. Shulman (1986) stated that the teacher should be aware of how curricula interrelate, how content knowledge overlaps between disciplines, and how the curriculum is arranged in other disciplines. An integrated approach is recommended for the organization and study of curriculum in the school. It can be seen that there exists a complex body of knowledge, independent of content knowledge and the pure disciplines, that is the mandate of teacher education programs. This knowledge should be that which is arranged and presented to preservice teachers during their preparatory programs.

In summarizing the current literature pertaining to teacher education, two important generalizations emerge: (1) A teacher education program must rest on a clearly defined paradigm which specifies objectives and the means to achieve these objectives. (2) Teacher education programs are only defensible in the acquisition and retention of a body of unique, practical and applicable knowledge. This knowledge should focus on the process of learning and cognition in both teachers and students.

MATHEMATICS TEACHER EDUCATION

Mathematics teacher education is considered from two perspectives, course content and course design. Course content refers to the knowledge and skills which form the curriculum of mathematics methods courses. Course design refers to the processes authors and researchers have employed in determining this curriculum. The present study represents an effort to determine the curriculum for mathematics methods programs, thus this research is of particular interest.

First consideration is given to research pertaining to course design. This research can be grouped according to the population which served as subjects for the study. The first group employed educational specialists as subjects to the study while the second employed student teachers.

Aviv and Cooney (1979) completed a questionnaire study pertaining to the status of secondary school mathematics teacher education programs. The sample population of the study included individuals associated with the Special Interest Group, Research in Mathematics Education (SIG/RME). The researchers mailed 125 questionnaires in October 1976, and mailed a second copy of the questionnaire one month later to those that had not responded. A total of 73 institutions were represented in the final results. The researchers discovered that the modal number of mathematics courses required above first year calculus was eight. Fifty-seven of 73 institutions required at least one secondary mathematics methods course, while three institutions required at least one elementary mathematics methods course. Sixteen of 73 institutions required more than one methods course and none of the institutions required more than one elementary mathematics methods course for secondary mathematics majors. The most common activities emphasized in secondary mathematics methods courses were lesson planning (68 responses), curriculum and unit planning (63 responses), test construction (63 responses), NCTM membership (61 responses), and attendance at a mathematics conference (60 responses). Eighteen respondants identified field based experience as the most important strength of their program. A total of sixteen respondants identified student teaching as the greatest problem encountered in their program. Twelve respondants specified a lack of time as their greatest problem.

Shafer (1969) also completed a study aimed at determining mathematics methods course curriculum by surveying education specialists. His study intended to determine

> ...what the leaders in mathematics and mathematics education felt the content of the methods course, offered the semester prior to the student teaching experience, should be; to evaluate experimentally their recommendations in the classroom; and to suggest an appropriate structure for the methods course based on this experimentation (p 623).

The study considered recommendations of committees and commissions responsible for the preparation of preservice mathematics teachers, recommendations of mathematics educators, structure of existing mathematics methods courses as described in professional journals, and the content of methods textbooks. Shafer´s research resulted in a list of topics most commonly included in methods courses. The six most common topics were: teaching geometry, teaching algebra, curriculum experimentation, teaching advanced topics in high school mathematics, test construction, and methods of lesson presentation. This document analysis was followed by a questionnaire sent to selected NCTM members to determine the relative number of periods which should be spent on each topic. The five topics assigned the greatest number of periods were: teaching algebra, teaching geometry, presentation of lessons by students, teaching advanced topics in High School mathematics, teaching Junior High school mathematics, and the evolution of mathematical concepts in grades K-12. A course was structured around this data and taught by the researcher.

The National Council of Teachers of Mathematics (NCTM) Commission on Preservice Education of Teachers of Mathematics (1973) authored a list of guidelines in the development of teacher training programs. The guidelines were arranged under three categories: (a) The academic and professional knowledge teachers should possess. The committee recommended that each teacher know more mathematics than he or she is expected to teach. (b) The professional competencies and attitudes a professional should exhibit. These guidelines include skills in communication, planning, diagnosis and evaluation. (c) The responsibilities of the institutions providing the teacher education program. The program should "reflect concern for recruitment, selecting, counseling, and placement of prospective teachers. Considerable emphasis is given to the provision for systematic program planning, review and evaluation" (p 706).

A second form of study which focuses on mathematics methods course design uses student teachers as informants. Two such studies were performed on a very informal basis, employing a small sample population. Both studies were used by an instructor of a mathematics methods course to provide a new focus for his course.

Lipsey (1982) conducted a survey study. Twenty-five student teachers were asked to record weekly questions which bothered them. The students submitted 170 questions. The most common questions concerned discipline, lesson planning, relations with cooperating teachers, evaluation, and student motivation. The researcher used the concerns submitted to restructure his methods course.

In Farmer and Farrell´s (1972) research, student teachers served as indirect informants. Feedback from students, their instructors, other faculty members, public school teachers and administrators was used in the redesign of the mathematics teacher training program at the State University of New York at Albany. Farmer and Farrell noted that

> Students fail to perceive the relationship between ´theory´ and practice, decry the lack of attention to individual progress, [and] point out the duplication and overlap in several of the required courses (p 773).

In response to these problems, the researchers designed a course intended to teach the "skills and understandings needed for a successful first year of teaching" (p 773). The course was to be one semester long and include studies in human psychology, evaluation and subject methodology while maintaining a focus on student teaching. The authors reported improved standards in integration, flexibility and individualization.

Earlier portions of this chapter have considered teacher and teaching effectiveness as the goals of teacher education programs, and have discussed the means through which these goals are accomplished through defined pedagogical paradigms. The content which supplies the substance of the program and meets the needs of the student and the teacher has not been addressed. What should be the content of mathematics methods courses?

Crouse (1974) reported on a method he employed in assisting preservice teachers to gain teaching experience. Crouse asked each student to present a one hour lesson and short quiz on any chosen mathematical topic. The class evaluated the quiz and the student teacher's lesson. This process enabled students to: learn content not found in regular mathematics courses; gain experience similar to that of teaching in a high school; gain confidence; receive feedback on teaching style, delivery systems and evaluation measures; and, experiment with a new teaching method.

Davidson (1977) took a different approach with the content of his methods course. He described an activity he employed to help his students focus on the teaching attributes essential for effective instruction. A class of preservice mathematics teachers was told they would see a demonstration of an effective mathematics instructor. The instructor was actually an anti-model and proceeded to deliver a disastrous lesson. Afterwards, students engaged in a discussion to list some observed poor teaching techniques. The poor techniques were grouped under the following headings (examples are in brackets): ragged beginning (rushed in late to class), lack of preparation and planning (had no examples planned in advance), ineffective style of presentation (rushed through material talking much too fast), lack of rapport with students (showed no enthusiasm), poor handling of questions (embarassed students who asked them), and poor blackboard technique (made messy, indistinct drawings). Davidson reported that preservice mathematics teachers watched for these same mistakes in their own teaching.

Dienes (1970) argued that math teachers should be taught in the same style which they should use when they in turn teach children. Teachers should be taught through ´concrete problem situations´ while learning to recognize, understand and interpret mathematical symbolism. He concluded that the content of mathematics methods courses should include:

> (1) The knowledge of a large number of mathematical structures; (2) The ability to recognize one mathematical structure as opposed to another; (3) The knowledge of some satisfactory coding systems; (4) Knowledge of how to encode; (5) Knowledge of how to decode (Dienes, 1970, p 267).

The author advocated these topics as the curriculum content of mathematics methods courses.

Sherrill (1973) compared the requirements specified by educational institutions, state governments and professional teachers of mathematics. He found that several disparities existed. Sherrill surveyed 313 elementary mathematics teachers and found that 74 had taken more than two mathematics content courses while 14 had taken more than two mathematics methods courses. Of the teachers surveyed, 236 had taken fewer than two mathematics methods courses while 136 teachers had taken less than two mathematics content courses. Sherrill found that teachers take more content courses than mathematics methods courses and that teachers believe preservice mathematics teachers should have two methods and two mathematics content courses. The researcher also surveyed 25 colleges and universities in the same states where the first phase of the study was conducted. Of these institutions, 17 required five or fewer hours of content study, while 19 required two or fewer hours of methods instruction. The researcher reports that these requirements exceed those required by the state governments represented. Sherrill concluded that a disparity exists between the recommendations of professional teachers, and the requirements of educational institutions and state governments.

Many authors suggest topics or methods which could be employed in mathematics teacher training programs. These suggestions are typically not based upon research but instead simply represent the viewpoint of the author. O'Daffer (1984) listed some activities which could be undertaken to help preservice mathematics teachers become more aware of the curriculum they teach. Davis (1984) discussed steps to help children learn the meaning of a mathematical term or concept and provided student teachers with a pattern to employ this strategy. Burger et al. (1983) described the mathematics teacher training program at the Oregon State University while Leake (1976) described the program at the University of Cincinnati. Swan and Jones (1969) suggested a plan to help preservice mathematics teachers develop an ability with percepts (mental visualizing) so the student teachers may in turn develop this ability in their students. The Committee to Develop Specifications for the Training of Teachers of Secondary Mathematics (a committee of the Michigan Council of Teachers of Mathematics) (1976), recommended a program with an emphasis on in-school experiences, especially to interact with non-motivated students. These topics represent a sampling of the recommendations being made by various committees, educators and specialists.

STUDENT TEACHING AS A DEVELOPMENTAL STAGE

Many articles have been written pertaining to various aspects of student teaching, but of particular concern are the developmental stages through which student teachers progress as they assume their professional roles. Iannacone, Fuller, Campbell and Wheatley, and Schempp have written articles specifically addressing this aspect of teacher education.

Iannacone (1963) views student teaching as a transitional stage between the college student role and that of a professional teacher. This stage enables student teachers to learn the behaviors necessary for teaching and to earn the right to teach by showing evidence of having developed appropriate behaviors. Iannacone´s study was conducted through the analysis of daily logs and diaries kept by 25 female student teachers. Major themes and common characteristics of the logs were identified and discussed. Iannacone sees three major stages of development: a break from the college student role, a period of role resolution, and a final acceptance of the teaching role resulting from actual teaching experiences. In the first stage, student teachers prepare to leave college. This stage includes filling out appropriate forms and learning to dress properly for the classroom. The second stage is characterized by anxiety as the student teacher has accomplished the break from the collegiate lifestyle, yet is unsure that he or she can meet the expectations of the teaching profession. The final stage is reached as the student teacher develops a relationship with the cooperating teacher and he or she gains experience and confidence in teaching.

In Iannacone´s research, the student teachers went through several changes as they made the shift from college student observer to professional teacher. At first the student teachers were horrified by their cooperating teachers´ classroom behaviors as these behaviors seemed inconsistent with the methods learned during college courses. As the student teachers began to see merit in the cooperating teacher´s methods and began to develop an ´it works´ attitude, the student teacher also began to identify with the cooperating teacher and logbooks changed from the singular ´I´, ´she´, and ´he´ to the collective ´we´. The role development also included replacing concern for student learning with concern for getting the whole class through the lesson. A student teacher perception which persisted throughout the student teaching round was: teaching was that which was done with the whole class, not individuals or small groups. To Iannacone the major contribution of student teaching to teacher training is the provision of a bridge between college training and professional roles. During this time student teachers learn to reject many of the precepts developed during college training.

Fuller (1969) provides a discussion of two short studies and a literature review of relevant articles up to the year 1969. This article has served as a guide to much of the work which has followed it. He states his purpose as__

> ...to examine intensively the developing concern of small groups of prospective teachers and to reexamine the findings of other investigators in the hope of discovering what teachers are concerned about and whether their concerns can be

> conceptualized in some useful way (p 208).

Fuller made the assumption that what student teachers say they need in way of training and what they actually receive are different entities. The first study was intended to scrutinize this difference. The study entailed the taping and analysis of discussions which occurred in group counseling sessions, a part of a seminar in the teacher training program. Six student teachers were involved for two hours each week for one semester. The expressed concerns fell into two categories: concern for self, and concern for pupils. The concern for self was primarily evidenced in the beginning stages of student teaching while concern for students did not appear until the end of the student teaching experience.

The second study Fuller described was conducted with 29 student teachers who recorded in writing ´what they were concerned about´. The responses were grouped under three headings:

> (1) Where do I stand? How adequate am I? How do others think I´m doing? (2) Problem behavior of pupils. Class control. (3) Are pupils learning? How does what I do affect their gain? (p 214).

Of the 29 responses, 22 fell in category (1), six students had concerns that fell in both category (1) and (2), while only one concern fell in category (2). No concerns were expressed for student learning. Fuller was led to conclude that all the students were primarily concerned with self-adequacy and student control, not with student learning.

A brief literature review of several studies allowed Fuller to merge the conclusions of these studies to postulate a three stage summary of student teachers´ concerns. The three stages include the Pre-Teaching Stage: Nonconcern; the Early Teaching Stage: Concern with Self; and the final stage, Late Concerns: Concern with Pupils. The first stage is characterized by preservice teachers prior to actual contact with teaching. A student´s lack of concern is attributed to his or her lack of knowledge about the field. The Early Teaching Phase is subdivided into two categories, Covert Concerns: Where Do I Stand?, and Overt Concerns: How Adequate Am I? The Covert Concerns include those of taking over control from the regular teacher and ascertaining available support from the administration (coping with the class). The overt concerns center on student teachers´ ability to: maintain control over the class, present and express knowledge of the material, and perform well through supervisory evaluations. Fuller notes that these concerns often occur concurrently. Only in the final phase is concern focused on the pupil. At this phase student teachers are concerned for student learning, understanding of student abilities and their own contributions to students´ achievements. Fuller concludes that as concern for student learning occurs only in latter stages of student teaching, students should have some teaching experience before enrolling in education courses.

Campbell and Wheatley (1983), like Iannacone and Fuller, identified sequential stages in the progression from college student to professional teacher. The stages identified were: "(1) concern with self, (2) concern with teaching actions and students' behavior, and (3) concern with learning" (p 60). The researchers noted that student teachers are rarely able to progress to the third stage during the teaching practicum. The study was informally conducted by observation of an unspecified number of student teachers over three consecutive years. In the first stage, student teachers were primarily concerned with their ability to cope with the rigors of the classroom. Their fears focused on personal concern for adequacy rather than on teaching or learning. A student teacher in the second stage became more aware of the classroom situation and was primarily concerned with planning proper activities and ensuring proper student behavior. The researchers noted that at this stage student teachers would prefer to have someone telling them what to do. Concern for learning does not occur until the final stage. At stage three, student teachers became aware of individual student achievement and not just general class involvement. Depending on the stage at which a student teacher exists in the progression of concerns, he or she will become more aware of various classroom conditions.

Schempp (1983) addresses two questions in his study: First, what modes of student interaction lead to

> role satisfaction for the prospective teacher? Secondly, what modes of student interaction lead to role competence for the novice teacher? (p 110).

Schempp conducted his study with 20 physical education student teachers aged 20 to 25 years studying at Kent Stage University. The student teachers were asked to complete two critical incidence forms, in writing, specifying an incident which illustrated role satisfaction and an incident which illustrated role competence. Major themes were identified and classified. The researcher discovered that "student teachers believed themselves competent when they told students to work on a teacher-planned activity and the entire class responded with social and emotional behavior the teacher felt was appropriate" (p 116). Student teachers, according to Schempp, appear most satisfied with their competency when working with, and in control of, the entire class. Schempp discovered that preservice physical education student teachers do not consider the development of psychomotor skills (learning) in students to be indicative of competent instruction. Student teachers are primarily concerned with control of the entire class.

Student teaching is an important component of mathematics teacher education. Because methods courses are intended to operate concurrently with the student teaching experience, it is necessary to consider what is important to student teachers when determining the curriculum for such methods instruction. Those experiences that student teachers view as sources of concern will also be the experiences that they identify as crucial for the content of courses in mathematics methods.

This literature review has considered the complex goals, concerns and paradigms of mathematics teacher education as they have been presented by educational scholars. All are of significance in the determination of a curriculum for a mathematics methods course. The reviewed literature represents that which is known about the training of effective mathematics teachers and the process whereby this training may be accomplished.

CHAPTER THREE

The Methodology

This study was performed as a case study employing the critical incidence method of data collection. This chapter presents the concept of case study and critical incident, and provides the methodology whereby the study was conducted.

CASE STUDY

The researcher's goal was to provide an accurate description of what effectiveness means to a small body of students. The researcher did not feel forced to test specific hypotheses, but rather allowed the individuals of the case (the informants) to elucidate the characteristics which they saw as significant to student teaching. The researcher was accountable to the informants; the researcher was responsible to accurately reflect and report that which the preservice teachers described in critical incident forms and interviews.

The case study method allowed for an information-rich study. This form of qualitative research was intended to describe rather than globally generalize or predict and evaluate. The expansive nature of case study accommodated the need to describe the plethora of relevant considerations in researching mathematics teacher effectiveness. There were many other advantages to case studies as summarized by Adelman.

Adelman et al. (1980) listed some reasons for performing case studies (a) Case studies are strong in reality. (b) Case studies strive to completely describe a given setting, and in the case of this research strive to answer the question: What does it mean to be effective in a teaching situation? This is the reality which the preservice teacher in a classroom faces. (c) A case study provides attention to the subtlety and complexity of the situation and its social truths. (d) A case study permits subsequent reinterpretation as the reader provides further interpretations to much of what the study reports. The researcher provides conclusions and interpretations, but the complexities of the subject and the situation of the reader might demand alternate interpretations or provide other insights. This phenomenon results primarily from the rich data collected in case studies. (e) Case studies imply action. Not all, but most case studies are performed in response to need. Whether or not case studies lead to action is determined by the purpose for which the research was begun and the conclusions made. (f) Finally, the information produced is in a publicly accessible form. As the researcher is accountable to the informants, the report is written in such a manner that it is useful to the informants. This particular piece of research was intended to be a realistic description of actual situations and was intended to take advantage of the characteristics of case study research as described above.

THE CRITICAL INCIDENT METHOD

In the critical incident method, the preservice teachers, while student teaching, completed a form (see Appendix A) describing personal experiences which were indicative of successful teaching experiences. On the same regular basis, student teachers completed a second form describing a personal experience which was indicative of a nonsuccessful teaching experience. There were several advantages which resulted from this method. First, the critical incidents which the preservice mathematics teachers described exposed the student-teachers' personal experiences. Second, these events were rooted in the reality of the classroom and in actual experiences, not in hypothetical or experimental situations. The incidents were genuine events experienced by the informants. Third, the incidents exposed the teaching strengths and weaknesses for each informant. Fourth, the descriptions of the events provided specific examples and situations in which individual traits were evidenced. These descriptions provided insight into the conditions which allowed effectiveness or ineffectiveness to be ascertained. Fifth, the incidents were recorded by the informants themselves. This enabled the informants to protect their own confidentiality. It was recognized that the researcher was entering into the lives of these informants, thus any information regarding them was ultimately their own. Finally, as the informants were requested to briefly describe the critical incident, the data returned was information rich.

The critical incident form was derived from a similar form used by Placek and Dodds (in press) in their study. The form was altered to ensure that data pertinent to this study was obtained. The form used in this study was one page in length. At the top of the page the following information was requested: name, sex, educational status, and the grade level in which the informant was student teaching. Also requested was the date on which the critical incident occurred and the topic which was being taught. The lower portion of the form had space for the student teacher to describe the critical incident in succinct language. This entailed description of the specific instance, the setting in which it occurred, and some detail about what made it successful or nonsuccessful.

THE METHOD

The students enrolled in the mathematics methods program were approached near the beginning of the semester and asked if they would be willing to participate in a study. Of the 32 students in the class, 27 were willing to sign release forms (see Appendix B). The preservice mathematics teachers had their role as participants in the study described to them in detail at that time. All of the participants in the study were students at the University of Alberta at the time of the study, and all of them were secondary mathematics majors. Both sexes were represented and several of the participants held previous degrees. Most of the participants were almost finished their undergraduate education degree. These 27 preservice teachers constituted the body of informants for this research.

The study employed three phases (see Figure 1). The first phase included the completion of critical incidence forms by student teachers practicing in the junior high school and a series of interviews conducted after the completion of the student teaching experience. The second phase of the study involved the completion of critical incidence forms during a senior high practicum along with the subsequent taped interviews. The third and final phase of the study was an interview with the instructor of the mathematics methods course to discuss the content, scope and sequence of the material presented and discussed.

The preservice teachers who served as informants to the study were asked to complete one success and one nonsuccess incidence form approximately every three to five school days

Figure 1: The three phases of the study.

Phase One:
(Junior High)

Completion of critical incidence forms
during EdPR 355

Interviews with three student teachers
(Darren, Susan, Troy)

Phase Two:
(Senior High)

Completion of critical incidence forms
during EdPR 356

Interviews with three student teachers
(Sheila, Bertrand, Anne)

- METHODS COURSE ENDS -

Phase Three:

Interview with Dr. Jones

---

while student teaching. In the junior high student teaching round this meant completing three success critical incidence forms and three nonsuccess critical incidence forms. In the senior high student teaching round this meant completing two success critical incident forms and two nonsuccess critical incidence forms (this round was shorter and interrupted by the spring break taken by the public school system). Not all student teachers completed all ten forms. In the junior high student teaching round, 18 student teachers completed and submitted a total of 40 success critical incidence forms and 34 nonsuccess critical incidence forms. In the senior high student teaching round, 15 student teachers completed and submitted a total of 34 success critical incidence forms and 27 nonsuccess critical incidence forms. Some forms which were referenced to the senior high were obtained in the first practicum (EdPR 355) from student teachers in rural placements. The reverse was also true in the second practicum (EdPR 356).

As the data sheets were collected, major themes were identified in each (see Coding the Data). The themes were then tabulated and combined with those of other informants. Interviews of selected student teachers were conducted at the conclusion of each student teaching round. All six of the interviewed student teachers were asked about: the nature of the student teaching experience, types of important teaching skills and attitudes, the content of the methods course, the usefulness of the methods course topics in the classroom, the role of the mathematics teacher, and the allocation of blame and credit (questions 1 through 22). The last three student teachers (those interviewed in the second phase of the study) were asked about the following additional topics: measuring student learning, differences between teaching in the junior high and senior high, and the relative influence of Dr. Jones and their cooperating teachers (questions 23 through 31). (See appendix C for a complete list of the questions.)

The student teachers who were interviewed were selected according to the following criteria: (1) willingness to participate in the interviews (all preservice teachers participating in the study were given the option of withdrawing from all or part of the study at any time if necessary), (2) provision of complete and insightful critical incidents. This second criterion was necessary because one of the purposes of the interviews was to clarify, and provide greater insight into, the critical incidents which were reported. There appeared little purpose in interviewing students who had not participated fully in the study, who were disinterested in the study, or who were uncooperative. (3) completion of the full quota of critical incidence forms. Some student teachers did not complete all the critical incident forms. (4) availability for interviewing. This was especially significant after the second student teaching round as some preservice teachers left Edmonton immediately after completing their practicum (which occurred at the end of their semester). (5) an equal number of females and males were interviewed.

Three critical incident forms of each type (successful and nonsuccessful) were distributed to each participant one week prior to the commencement of each school placement. Each participant was also given a plain brown envelope in which the forms could be sealed and returned to the researcher once completed. The forms were either returned directly to the researcher or via the faculty consultant who returned them to the researcher.

One interview was conducted with Dr. Jones, the instructor of the mathematics methods course. The purpose of this interview was to determine the content of the mathematics methods course, the topics that were addressed, how these topics were addressed, the order in which they were addressed, how the topics were linked, and how the course was evaluated. The list of questions asked of Dr. Jones during this interview is found in Appendix C.

CODING THE DATA

Once all critical incident forms had been collected, the coding process was begun.

In coding the critical incidence forms, three steps were undertaken. In the first step, all of the critical incidence forms were read from beginning to end twice. This gave the researcher a clear idea of the kinds of incidents that were reported and the manner in which they were recorded. This initial step gave the researcher a general idea of the types of categories which would be necessary to describe the data. The critical incidents were coded in rough on the second reading. In the second step critical incidence forms which had obvious themes were used to establish initial categories. Consider this quote from one critical incidence form:

> CRITICAL INCIDENT: This period, although aware of a test tomorrow, there were two or three boys who refused to work and continued to goof off. After warnings, I removed one student to the hall. I felt there must have been something I should have done prior to that time.

In this example, the preservice teacher is obviously writing about a discipline problem and what she did to rectify the problem. Forms such as these, where one clear theme was expressed, were used to help develop a framework for assessing other more ambiguous forms. By listing the descriptors associated with the non-ambiguous instances, the lists could be used for reference when coding the more ambiguous instances. The third step was actually a repetition of stages one and two. The forms were read again and the descriptors for each theme were updated. This spiral model ~~was~~ repeated until all the forms were read through and no descriptors were changed and no form was recoded. The data appeared internally consistent.

The spiral model, as described above, may be conceptualized as slowly moving forward through the data while constantly looking back at what has gone before. The result of this process is the development of a list of characteristics which describe factors determining successful and nonsuccessful teaching as recorded by the preservice teachers. The descriptors for each theme are listed in Chapter Four.

Some preservice teachers described more than one instance or theme on one critical incidence form. These forms were coded under two themes. It was possible to report in such a way that three or more themes were expressed, but this did not happen. In the set of data collected during the first phase of the study, a total of 12 forms (8 success, 4 nonsuccess) were classified as expressing two themes. In the set of data collected during the second student teaching round, a total of 2 forms (both nonsuccess incidents) were classified as expressing two themes.

One of the following conditions had to exist in order for a critical incident to be classed under two themes: (1) The instance described must have an equal number of the characteristics associated with two different themes. If more characteristics of one theme were expressed than of another even though traces of both were evident, the instance would be coded according to the theme with the greatest number of expressed characteristics. (2) The instance may be categorized under more than one theme if it had all of the characteristics of both themes clearly present in the description.

To ensure reliability in the coding of the data, five success and five nonsuccess critical incidence forms were selected at random from those returned in the first phase of the study. These forms were coded by an independent assistant familiar with the critical incident method, familiar with the study, and familiar with mathematics education. This assistant coded 5 out of 5 nonsuccess forms identically to the researcher, and 4 out of 5 success forms identically. The researcher and assistant agreed upon the theme of the remaining form after a brief discussion and realized that their difference was a matter of terminology and not error. The process was repeated with the critical incidence forms collected in the second round of student teaching. The assistant coded 5 out of 5 success forms identically and 5 out of 5 nonsuccess forms identically.

TREATMENT OF THE DATA

Once all of the critical incidents had been thematically coded, percentages were calculated. For each theme, three percentages were derived. The first percentage was calculated using the formula below:

Formula A:

$$\text{Percent} = \frac{\text{\# PSTs Describing this Theme} \times 100}{\text{Total \# PSTs Returning Forms}}$$

(rounded to one decimal place)
(PST - Preservice teacher)

This percentage represented the relative occurrence of given themes among the student teachers. A high percentage in this category meant that most of the informants in this study experienced a similar instance of success or nonsuccess while student teaching. The second percentage was calculated using this formula:

Formula B:

$$\text{Percent} = \frac{\text{\# Occurrences of Theme} \times 100}{\text{\# C. I. Forms Returned}}$$

(rounded to one decimal place)

This percentage represented the relative occurrence of each theme among the critical incidents. A high percentage here meant that the incident was commonly reported. The final percentage was calculated using the following formula:

Formula C:

$$\text{Percent} = \frac{\text{\# Occurrences of Theme} \times 100}{\text{Total \# of Critical Incidents}}$$

(rounded to one decimal place)

Though the percentages obtained through Formulas B and C provide similar information, both are retained as Formula B emulates the calculations made by Placek and Dodds (in press) and Formula C provides values which total 100%. Having values that totalled 100% made it easier to compare the relative occurrence of the themes and the three developmental stages.

The data were grouped and compared in four ways using the percentages described above. The four ways the data were grouped included: (1) differences resulting from the age of students taught, (2) gender differences in student teaching, (3) differences resulting from prior study, and (4) differences in teaching perception occurring over time.

The researcher decided to compare the occurrence of critical incidents in the Senior High school and the occurrence of critical incidents in the Junior High school because of the research completed by Placek and Dodds (in press). Placek and Dodds found that there were differences in perceptions of successful and nonsuccessful teaching by student teachers in the elementary and secondary schools. Student teachers in the elementary school were found to be more concerned with student learning than were their counterparts in the secondary school. On the basis of this evidence, the researcher wondered if there existed any difference in perceptions of successful and nonsuccessful teaching by student teachers placed in the Junior High and Senior High schools.

The decision to compare the incidents of successful and nonsuccessful student teaching for males and females was based upon the work of Placek and Dodds (in press) and Schroeder and Frame (1986). Placek and Dodds found that there were no significant differences between perceived instances of success and nonsuccess for males and females in the physical education discipline. Mathematics is a discipline traditionally innundated with males. Schroeder and Frame found that only 25% of all secondary mathematics teachers in Alberta were female. On the basis of this work, the researcher wondered if there existed any difference in perceptions of secondary mathematics teaching between females and males.

The decision to divide the data to compare instances of successful and nonsuccessful teaching for first degree and after degree undergraduate students was based on the work of Joyce and Clift (1985), Murray (1982), Greenberg (1983), and Wisniewski (1983). Joyce and Clift argued that teacher education should not be offered as an undergraduate degree and that students should complete their initial studies in their subject disciplines. Murray advocated the expansion of the four-year program to include a fifth year. Greenberg demanded longer and more intense programs, preferably in graduate studies. Wisniewski argued that the four-year program is not adequate and needs to be expanded. Based on the opinions of these authors, the researcher wondered if there existed any differences between the perceptions of successful and nonsuccessful teaching in first degree students and the perceptions of successful and nonsuccessful teaching in after degree students.

The decision to divide the data into early, middle and late time periods was based on the work of Iannaccone (1963), Fuller (1969), and Campbell and Wheatley (1983). Iannaccone indicated that student teachers perceive teaching differently at different times during the practicum. Both Fuller and Campbell and Wheatley described distinct stages through which student teachers progress in the transformation from student teacher to teacher. Fuller and Campbell and Wheatley both stated that student teachers rarely progress to a concern for learning during their student teaching placements. Based on the work of these authors, the researcher wondered what differences in perceptions of successful and nonsuccessful teaching would occur in the early, middle and late time periods of the teaching practicum.

Within each of these four data comparisons, the differences between the success and nonsuccess instances were reported. The data are tabulated and discussed in the chapters that follow.

The treatment of the data as described above was completed only with the themes as they were identified by the researcher. The original critical incidents, as they were submitted by the preservice teachers, were retained and used in subsequent chapters to provide examples and illustrations of the incidents the informants described.

Data were considered admissable if they had been recorded by student teachers on critical incident forms and submitted to the researcher. The descriptions on the critical incident forms had to be legible and describe at least one success or nonsuccess critical incident. One critical incident was deemed unacceptable as no clear theme was evident. That critical incident was dropped from the study.

CHAPTER FOUR

Presentation of the Data

The purpose of this chapter is to present the data as they have been collected from each phase of this study. A description of each of the themes which emerged from coding the critical incidence forms is included. Separate descriptions are presented for the success and nonsuccess critical incidents (examples of each are found in Appendix F). Also included in this chapter are the percentage tables created by summarizing the themes described in Chapter Three.

THE THEMES

With both the success and nonsuccess critical incidence forms, ten themes emerged. These ten themes are: Planning and Preparation, Self Acceptance of Teaching Role, Student Acceptance of Teaching Role, Classroom Environment, Teaching Methods, Discipline, Work Accomplishment, Motivating Students, Sensitivity to Student Learning, and Learning. These themes are discussed in turn beginning with the success critical incidence form descriptors.

Planning and Preparation In a critical incident which is coded as Planning and Preparation, a ´before the fact´ description is given. The description explains the steps completed and the activities involved in preparing and organizing materials for instruction. Focus is placed on the work done by the preservice teacher, and usually entails the preparation of lesson plans. This critical incident may also describe the time span involved in preparing the materials.

Self Acceptance of Teaching Role In this type of critical incident, preservice teachers describe ways that their own teaching behavior has changed. These changes are typically in response to some problem (which is often a discipline problem), but the problem itself is not the focus of the discussion. The description concentrates on the steps the preservice teacher made to overcome the problem. These steps entail clarification of the preservice teacher's expectations and clarification of the preservice teacher's role as teacher in the classroom. Often the incident is one in which the student teacher assumes responsibility and authority over the classroom environment. These incidents sometimes describe how the teacher distances him or herself from the students. This incident must not describe (in depth) the change in behavior of the students, otherwise it would be classified as a Discipline incident. When this incident does describe incidents which relate to discipline, it does not focus on a particular incident. Instead, the critical incident describes how the student teacher has set down new rules which remain in effect over a long time span (for example, until the end of the student teaching round).

Student Acceptance of Teaching Role Stated simply, this theme entails being seen as a teacher by the students. In the description, preservice teachers describe an event which illustrates how they came to assume the role of teacher in the eyes of the students. This incident often leads to enhanced respect, rapport, cooperation and obedience from the students. Such words as ´identity´ and ´accepted´ are often used.

Classroom Environment In this critical incident, the preservice teacher describes the measures undertaken to overcome a logistical problem in the classroom. These events may deal with being able to manipulate the physical surroundings such as equipment, lighting and temperature or may deal with surprise events such as having students called out of the classroom unexpectedly.

Teaching Methods In order for a critical incident to be classified as Teaching Methods, it must describe the technique whereby a mathematical topic was presented. These descriptions typically contain some detail about the concept being discussed and often give specific blackboard examples. Little detail is provided about why the subject was taught in the described way or how well the subject matter was mastered. The focus of the discussion is on what the preservice teacher did to teach the concept. How it contributes to the students´ learning and the nature and extent of what is learned is not emphasized (if mentioned at all). In instances where the teacher is working with one student, the description often details the flow of the conversation.

Discipline Describes the resolution of a student behavior problem in the classroom. The description contains some detail about the nature of the problem, what measures were taken, and how effective the measures were. The measure that was taken must be an action performed by the student teacher with the expressed intent of changing the student´s behavior. The discipline problem typically occurs over a very short time span. The measure is always taken in response to a student or students´ misbehavior.

Work Accomplishment In this type of critical incident, a description is given of a specific event which led students to get work completed. There is little or no discussion of how well students understand the material, but there may be some discussion of how well the students behaved while they were working. These descriptions sometimes include the length of time involved.

Motivating Students The focus of the discussion in this type of critical incident is on how well the students were motivated to participate in class activities. Often this motivation is linked to some specific teaching method, but the focus is on the student response rather than what the teacher did. The description gives some detail about the topic being studied and how the students became interested in the topic. This incident is typically associated with a mathematical application. It often describes the responses of the students in positive terms (for example, students ask good questions, cooperate, participate, show interest). The description often uses such words as ´motivated´, ´interested´ and ´enthusiastic´. The description sometimes includes expected student behavior had the same technique not been used.

Sensitivity to Student Learning This type of critical incident focuses on how the preservice teacher was aware of the level of the students´ understanding or areas of difficulty. In the description, the student teacher does not enter into a discussion about the students, or their learnings, or the method used. The description primarily centres on how the student teacher became aware of the students´ difficulties in learning. These descriptions sometimes mention how the incident helped them to move on to other material.

Learning When critical incidents focus on learning, they typically entail the description of the topic which the student(s) mastered and the method by which it was mastered. Such a description also includes the students´ behavior at the time and provides a specific measure for the student learning (for example, the answering of questions and problems, tests, and quizzes). These descriptions often include such words as: learned, comprehended, reasoned, and prepared.

The same ten thematic categories exist for the nonsuccess incidents. In most respects they are the antithesis of those pertaining to success incidents. Each shall be discussed in turn.

Planning and Preparation This critical incident entails the creation of ineffective lesson plans or exams. The ineffective materials typically lead to questions from the students and general confusion. Often the error in the materials is a failure to anticipate areas of student difficulty. The description will contain some detail about the consequences of the planning error and how the problem could have been avoided or what would be done differently next time. The focus is placed on what the student teacher did not do or else did incorrectly. Typical planning errors include selecting inappropriate materials for a particular grade level, failure to organize the material in ordered steps, or inappropriate amounts of material within time restraints.

Self Acceptance of Teaching Role In this type of critical incident, the preservice teacher usually regrets not having set clear expectations. Failure to set expectations results in inappropriate student behaviors over a longer time span (not an isolated incident). The student teacher often accepts blame for not having established rules and states the consequences resulting from the lack of order. Sometimes the student teachers express doubt in themselves which results in ineffective teaching, confusion, being flustered, and negative emotions.

Student Acceptance of Teaching Role In this type of critical incident, the students do not take the teacher seriously and this is manifested in a lack of cooperation, obedience and work. The preservice teacher is seen as only a student teacher. The preservice teacher is sometimes seen as less than a teacher due to the presence of the cooperating teacher. This incident may lead the student teacher to report a loss of self-confidence. This theme may also arise when the student teacher is left alone with the class and is simply not accepted as the teacher.

Classroom Environment The difficulty that is reported as a function of this critical incident is a product of some logistic technicality of the classroom, such as the arrangement of tables and chairs, the classroom temperature or lighting. Student teachers may mention how this incident leads to discipline problems, but the problem is not discussed in detail and is not the focus of the discussion. The focus is placed on the self and what was not done in order to maintain good classroom control.

Teaching Methods This critical incident is created by the use of an ineffective example or demonstration. The fact that the students are confused and do not learn is de-emphasized. Learning is not the focus. The Teaching Methods description often mentions that students were lost, that the lesson should be redone, and how it should be done differently. Sometimes the erroneous teaching method is a function of poor lesson pacing.

Discipline This critical incident refers to the preservice teacher´s action to overcome a specific student behavioral difficulty, an action that was ineffective. The student teacher often expresses helplessness and an inability to deal with the problem or decide upon the appropriate measures to be taken. There is usually some detail about the nature of the discipline problem. Some student teachers report that they should have acted sooner or more forcefully.

Work Accomplishment In this critical incident, work is never completed. There is usually some description about the conditions that led to the work being incomplete and usually some detail about the task that was to be completed. This failure to work often leads to other problems such as one student´s inability to keep up with the class or do his or her homework. Students often become poorly disciplined, uncooperative and begin to complain about their workload.

Motivating Students In this type of critical incident, the student teacher is unable to get the students to want to learn or do work. Some detail is provided about the ineffective method used to get the students involved, but no detail is given about the intended learnings or concepts.

The student teacher usually accepts blame for an inability to motivate the students.

Sensitivity to Student Learning In this critical incident, the student teacher reports that he or she is unable to read the cues from students when the students indicate their frustration or confusion. The focus is not placed on what is or is not learned, but on the preservice teacher´s inability to understand his or her students. This sometimes leads to a feeling of failure and incompetence.

Learning To express a Learning theme, the description must include a specific intended learning outcome (objective). The description must include a measure for testing the learning, some detail about the concept that was taught, and a statement that the objective was not reached by any or by very few of the students.

RESULTS FROM THE CRITICAL INCIDENCE FORMS

The tables that follow summarize the frequency of occurrence of each theme according to four classifications: differences resulting from the age of students taught, gender differences in student teaching, differences resulting from prior study, and differences in teaching perception occurring over time. For each classification the success and nonsuccess critical incidents have been tabulated separately.

The tables are organized according to the following format. The themes under which the critical incidents were coded appear along the left edge of the tables. The ten themes (as well as the one ´other´ theme entitled Evaluation by Faculty Consultant) are divided into the three developmental stages as described by Campbell and Wheatley (1983). The themes Planning and Preparation, Self Acceptance of Teaching Role, Student Acceptance of Teaching Role, and Evaluation by Faculty Consultant are all consistent with stage one concern for self-adequacy. The themes Classroom Environment, Discipline, Teaching Methods, Work Accomplishment, and Motivating Students are consistent with stage two concerns for classroom conditions and teaching routines. The themes Sensitivity to Student Learning and Learning are consistent with stage three concern for student learning.

Within each table the values tabulated for success and nonsuccess critical incidents are listed separately. For both the success and nonsuccess critical incidents, three percentages for each theme are provided. These percentages are entitled percentage A (see page 57, abbreviated as %A), percentage B (abbreviated %B), and percentage C (abbreviated %C). The %A represents the percentage of student teachers which provided at least one critical incident expressing a given theme. The %B represents the percentage of critical incidence forms on which a given theme appeared. The %C represents the percentage of the total number of themes which are attributed to a given theme. All percentages are rounded to one decimal place.

Because the number of critical incidence forms filled in by individual student teachers ranged from one to twelve, and because some critical incidents expressed more than one theme, it was necessary to include all three percentages. It was possible for one student teacher to write several critical incidents all having the same theme. If only the %A was used, the frequency of occurrence of the theme would be lost, and if only the %B was used, it would not be known how universal the theme actually was. The third percentage, %C, was included so that totals for each developmental stage could be calculated making comparisons between the stages possible.

As an example, consider the marked region in Table 3. The values in this portion of the table may be interpreted as follows: (1) 21.1% of the student teachers (who completed success critical incidence forms in the junior high practicum) recorded at least one critical incident which had the theme Work Accomplishment; (2) 9.3% of the success critical incidence forms collected in this student teaching round expressed the Work Accomplishment theme; and (3) 8.0% of all the themes discovered in this set of critical incidence forms were classified as Work Accomplishment. From the section of the table marked on Table 3, it can also be concluded that the Motivating Students theme is more localized than the Work Accomplishment theme. This may be seen in the fact that an equal percentage of student teachers (%A: 21.1%) expressed each theme, but the Motivating Students theme was expressed more often (%B: 11.6%) than the Work Accomplishment theme (%B: 9.3%).

Table 2
Percentage Occurrence of Success and Nonsuccess Critical Incidents: Summary

	SUCCESS			NONSUCCESS		
	%A:20	%B:77	%C:84	%A:20	%B:66	%C:72*
Plan. and Preparation	20.0	5.2	4.8	40.0	18.2	16.7
Self Accept. of Role	10.0	3.9	3.6	15.0	6.1	5.6
Stu. Accept. of Role	45.0	20.8	19.0	25.0	9.1	8.3
Eval. by Fac. Consult.	0.0	0.0	0.0	5.0	1.5	1.4
**Stage 1 Totals:			27.4			32.0
Classroom Environ.	15.0	3.9	3.6	15.0	6.1	5.6
Teaching Methods	55.0	24.7	22.6	40.0	21.2	19.4
Discipline	55.0	14.3	13.1	60.0	30.3	27.8
Work Accomplishment	20.0	5.2	4.8	15.0	3.0	4.2
Motivating Students	40.0	15.6	14.3	10.0	3.0	2.8
Stage 2 Totals:			58.4			59.8
Sen. to Stu. Learning	20.0	7.8	7.1	20.0	6.1	5.6
Learning	20.0	7.8	7.1	5.0	3.0	2.8
Stage 3 Totals:			14.2			8.4
Total Percentage C:			100.0			100.2

* - values represent respective sample sizes
- %A: percentage of student teachers by theme
%B: percentage of critical incidence forms by theme
%C: percentage of critical incidents by theme
** - Stages defined by Campbell and Wheatley - see page 42

Table 3
Percentage Occurrence of Success and Nonsuccess Critical Incidents at the Junior High Level

	SUCCESS			NONSUCCESS		
	%A:19	%B:43	%C:50	%A:19	%B:39	%C:43*
Plan. and Preparation	10.5	4.7	4.0	26.3	20.5	18.6
Self Accept. of Role	10.5	4.7	4.0	10.5	7.7	7.0
Stu. Accept. of Role	31.6	18.6	16.0	15.8	7.7	7.0
Eval. by Fac. Consult.	0.0	0.0	0.0	5.3	2.6	2.3
**Stage 1 Totals:			24.0			34.9
Classroom Environ.	15.8	7.0	6.0	10.5	5.1	4.7
Teaching Methods	52.6	30.2	26.0	21.1	12.8	11.6
Discipline	36.8	16.3	14.0	52.6	33.3	30.2
Work Accomplishment	21.1	9.3	8.0	15.8	7.7	7.0
Motivating Students	21.1	11.6	10.0	5.3	2.6	2.3
Stage 2 Totals:			64.0			55.8
Sen. to Stu. Learning	10.5	7.0	6.0	15.8	7.7	7.0
Learning	10.5	7.0	6.0	5.3	2.6	2.3
Stage 3 Totals:			12.0			9.3
Total Percentage C:			100.0			100.0

* - values represent respective sample sizes
 - %A: percentage of student teachers by theme
 %B: percentage of critical incidence forms by theme
 %C: percentage of critical incidents by theme
** - stages defined by Campbell and Wheatley - see page 42

Table 4
Percentage Occurrence of Success and Nonsuccess Critical Incidents at the Senior High Level

	SUCCESS			NONSUCCESS		
	%A:15	%B:34	%C:34	%A:14	%B:27	%C:29*
Plan. and Preparation	13.3	5.9	5.9	28.6	14.8	13.8
Self Accept. of Role	6.7	2.9	2.9	7.1	3.7	3.4
Stu. Accept. of Role	46.7	23.5	23.5	21.4	11.1	10.3
Eval. by Fac. Consult.	0.0	0.0	0.0	0.0	0.0	0.0
**Stage 1 Totals:			32.3			27.5
Classroom Environ.	0.0	0.0	0.0	14.3	7.4	6.9
Teaching Methods	40.0	17.6	17.6	50.0	33.3	31.0
Discipline	26.7	11.8	11.8	28.6	25.9	24.1
Work Accomplishment	0.0	0.0	0.0	0.0	0.0	0.0
Motivating Students	46.7	20.6	20.6	7.1	3.7	3.4
Stage 2 Totals:			50.0			65.4
Sen. to Stu. Learning	20.0	8.8	8.8	7.1	3.7	3.4
Learning	20.0	8.8	8.8	7.1	3.7	3.4
Stage 3 Totals:			17.6			6.8
Total Percentage C:			99.9			99.7

* - values represent respective sample sizes
- %A: percentage of student teachers by theme
  %B: percentage of critical incidence forms by theme
  %C: percentage of critical incidents by theme

** - stages defined by Campbell and Wheatley - see page 42

Table 5
Percentage Occurrence of Success and Nonsuccess Critical Incidents Reported by Females

	SUCCESS			NONSUCCESS		
	%A:13	%B:47	%C:52	%A:12	%B:39	%C:45*
Plan. and Preparation	23.1	6.4	5.8	58.3	25.6	22.2
Self Accept. of Role	0.0	0.0	0.0	16.7	5.1	4.4
Stu. Accept. of Role	46.2	17.0	15.4	41.7	15.4	13.3
Eval. by Fac. Consult.	0.0	0.0	0.0	8.3	2.6	2.2
**Stage 1 Totals:			21.2			42.1
Classroom Environ.	15.4	4.3	3.8	16.7	5.1	4.4
Teaching Methods	53.8	27.7	25.0	25.0	17.9	15.6
Discipline	61.5	17.0	15.4	50.0	30.8	26.7
Work Accomplishment	23.1	6.4	5.8	25.0	7.7	6.7
Motivating Students	38.5	17.0	15.4	8.3	2.6	2.2
Stage 2 Totals:			65.4			55.6
Sen. to Stu. Learning	15.4	6.4	5.8	8.3	2.6	2.2
Learning	23.1	8.5	7.7	0.0	0.0	0.0
Stage 3 Totals:			13.5			2.2
Total Percentage C:			100.1			99.9

* - values represent respective sample sizes
- %A: percentage of student teachers by theme
%B: percentage of critical incidence forms by theme
%C: percentage of critical incidents by theme
** - stages defined by Campbell and Wheatley - see page 42

Table 6
Percentage Occurrence of Success and Nonsuccess Critical Incidents Reported by Males

	SUCCESS			NONSUCCESS		
	%A:7	%B:30	%C:32	%A:7	%B:27	%C:27*
Plan. and Preparation	14.3	3.3	3.1	14.3	7.4	7.4
Self Accept. of Role	28.6	10.0	9.4	14.3	7.4	7.4
Stu. Accept. of Role	57.1	26.7	25.0	0.0	0.0	0.0
Eval. by Fac. Consult.	0.0	0.0	0.0	0.0	0.0	0.0
**Stage 1 Totals:			37.5			14.8
Classroom Environ.	14.3	3.3	3.1	14.3	7.4	7.4
Teaching Methods	57.1	20.0	18.8	71.4	25.9	25.9
Discipline	42.9	10.0	9.4	85.7	29.6	29.6
Work Accomplishment	14.3	3.3	3.1	0.0	0.0	0.0
Motivating Students	42.9	13.3	12.5	14.3	3.7	3.7
Stage 2 Totals:			46.9			66.6
Sen. to Stu. Learning	28.6	10.0	9.4	42.9	11.1	11.1
Learning	14.3	6.7	6.3	14.3	7.4	7.4
Stage 3 Totals:			15.7			18.5
Total Percentage C:			100.1			99.9

* - values represent respective sample sizes
- %A: percentage of student teachers by theme
  %B: percentage of critical incidence forms by theme
  %C: percentage of critical incidents by theme

** - stages defined by Campbell and Wheatley - see page 42

Table 7
Percentage Occurrence of Success and Nonsuccess Critical Incidents Reported by First Degree Student Teachers

	SUCCESS			NONSUCCESS		
	%A:11	%B:40	%C:45	%A:10	%B:34	%C:39*
Plan. and Preparation	18.2	5.0	4.4	50.0	20.6	17.9
Self Accept. of Role	9.1	5.0	4.4	30.0	11.8	10.3
Stu. Accept. of Role	36.4	15.0	13.3	30.0	11.8	10.3
Eval. by Fac. Consult.	0.0	0.0	0.0	10.0	2.9	2.6
**Stage 1 Totals:			22.1			40.7
Classroom Environ.	9.1	2.5	2.2	10.0	2.9	2.6
Teaching Methods	54.5	30.0	26.7	40.0	23.5	20.5
Discipline	54.5	15.0	13.3	50.0	20.6	17.9
Work Accomplishment	27.3	7.5	6.7	10.0	2.9	2.6
Motivating Students	27.3	10.0	8.9	10.0	2.9	2.6
Stage 2 Totals:			57.8			46.2
Sen. to Stu. Learning	18.2	10.0	8.9	30.0	8.8	7.7
Learning	27.3	12.5	11.1	10.0	5.9	5.1
Stage 3 Totals:			20.0			12.8
Total Percentage C:			99.9			100.1

* - values represent respective sample sizes
- %A: percentage of student teachers by theme
%B: percentage of critical incidence forms by theme
%C: percentage of critical incidents by theme
** - Stages defined by Campbell and Wheatley - see page 42

Table 8
Percentage Occurrence of Success and Nonsuccess Critical Incidents Reported by After Degree Student Teachers

	SUCCESS			NONSUCCESS		
	%A:9	%B:38	%C:40	%A:8	%B:31	%C:32*
Plan. and Preparation	22.2	5.3	5.0	37.5	16.1	15.6
Self Accept. of Role	11.1	2.6	2.5	0.0	0.0	0.0
Stu. Accept. of Role	66.7	26.3	25.0	25.0	6.5	6.3
Eval. by Fac. Consult.	0.0	0.0	0.0	0.0	0.0	0.0
Stage 1 Totals:			32.5			21.9
Classroom Environ.	22.2	5.3	5.0	25.0	9.7	9.4
Teaching Methods	55.6	18.4	17.5	50.0	19.4	18.8
Discipline	66.7	15.8	15.0	75.0	38.7	37.5
Work Accomplishment	11.1	2.6	2.5	25.0	6.5	6.3
Motivating Students	55.6	21.1	20.0	12.5	3.2	3.1
Stage 2 Totals:			60.0			75.1
Sen. to Stu. Learning	22.2	5.3	5.0	12.5	3.2	3.1
Learning	11.1	2.6	2.5	0.0	0.0	0.0
Stage 3 Totals:			7.5			3.1
Total Percentage C:			100.0			100.1

* - values represent respective sample sizes
- %A: percentage of student teachers by theme
%B: percentage of critical incidence forms by theme
%C: percentage of critical incidents by theme
** - stages defined by Campbell and Wheatley - see page 42

Table 9
Percentage Occurrence of Success and Nonsuccess Critical Incidents in the Early Term

	SUCCESS			NONSUCCESS		
	%A:14	%B:23	%C:26	%A:11	%B:20	%C:23*
Plan. and Preparation	7.1	4.3	3.8	36.4	35.0	30.4
Self Accept. of Role	14.3	8.7	7.7	9.1	10.0	8.7
Stu. Accept. of Role	21.4	13.0	11.5	9.1	5.0	4.3
Eval. by Fac. Consult.	0.0	0.0	0.0	9.1	5.0	4.3
**Stage 1 Totals:			23.0			47.7
Classroom Environ.	14.3	8.7	7.7	9.1	5.0	4.3
Teaching Methods	50.0	39.1	34.6	27.3	15.0	13.0
Discipline	7.1	4.3	3.8	27.3	15.0	13.0
Work Accomplishment	21.4	13.0	11.5	18.2	10.0	8.7
Motivating Students	7.1	8.7	7.7	9.1	5.0	4.3
Stage 2 Totals:			65.3			43.3
Sen. to Stu. Learning	7.1	4.3	3.8	18.2	10.0	8.7
Learning	7.1	8.7	7.7	0.0	0.0	0.0
Stage 3 Totals:			11.5			8.7
Total Percentage C:			99.8			99.7

Note: 4 forms were not dated.
* - values represent respective sample sizes
- %A: percentage of student teachers by theme
%B: percentage of critical incidence forms by theme
%C: percentage of critical incidents by theme
** - stages defined by Campbell and Wheatley - see page 42

Table 10
Percentage Occurrence of Success and Nonsuccess Critical Incidents in the Middle Term

	SUCCESS			NONSUCCESS		
	%A:13	%B:23	%C:26	%A:16	%B:22	%C:23*
Plan. and Preparation	0.0	0.0	0.0	12.5	9.1	8.7
Self Accept. of Role	7.7	4.3	3.8	12.5	9.1	8.7
Stu. Accept. of Role	61.5	34.8	30.8	12.5	9.1	8.7
Eval. by Fac. Consult.	0.0	0.0	0.0	0.0	0.0	0.0
Stage 1 Totals:			34.6			26.1
Classroom Environ.	7.7	4.3	3.8	6.3	4.5	4.3
Teaching Methods	23.1	17.4	15.4	18.8	22.7	21.7
Discipline	23.1	13.0	11.5	43.8	31.8	30.4
Work Accomplishment	7.7	4.3	3.8	0.0	0.0	0.0
Motivating Students	23.1	13.0	11.5	6.3	4.5	4.3
Stage 2 Totals:			46.0			60.7
Sen. to Stu. Learning	23.1	13.0	11.5	6.3	4.5	4.3
Learning	7.7	8.7	7.7	6.3	9.1	8.7
Stage 3 Totals:			19.2			13.0
Total Percentage C:			99.8			99.8

Note: 4 forms were not dated.
* - values represent respective sample sizes
- %A: percentage of student teachers by theme
%B: percentage of critical incidence forms by theme
%C: percentage of critical incidents by theme
** - stages defined by Campbell and Wheatley - see page 42

Table 11
Percentage Occurrence of Success and Nonsuccess Critical Incidents in the Late Term

	SUCCESS			NONSUCCESS		
	%A:12	%B:24	%C:24	%A:13	%B:20	%C:22*
Plan. and Preparation	16.7	8.3	8.3	23.1	15.0	13.6
Self Accept. of Role	0.0	0.0	0.0	0.0	0.0	0.0
Stu. Accept. of Role	41.7	20.8	20.8	23.1	13.6	13.6
Eval. by Fac. Consult.	0.0	0.0	0.0	0.0	0.0	0.0
Stage 1 Totals:			29.1			27.2
Classroom Environ.	0.0	0.0	0.0	15.4	10.0	9.1
Teaching Methods	41.7	20.8	20.8	46.2	30.0	27.3
Discipline	33.3	16.7	16.7	30.8	30.0	27.3
Work Accomplishment	0.0	0.0	0.0	7.7	5.0	4.5
Motivating Students	33.3	16.7	16.7	0.0	0.0	0.0
Stage 2 Totals:			54.2			68.2
Sen. to Stu. Learning	16.7	8.3	8.3	7.7	5.0	4.5
Learning	16.7	8.3	8.3	0.0	0.0	0.0
Stage 3 Totals:			16.6			4.5
Total Percentage C:			99.9			99.9

Note: 4 forms were not dated.
* - values represent respective sample sizes
 - %A: percentage of student teachers by theme
 %B: percentage of critical incidence forms by theme
 %C: percentage of critical incidents by theme
** - stages defined by Campbell and Wheatley - see page 42

THE TAPED INTERVIEWS

In total, seven interviews were conducted during the course of this study. Three interviews were completed after the first practicum and three after the second practicum. These interviews helped determine what skills transferred from the mathematics methods course to the student teaching placements. The interviews also provided information regarding the nature of the student teaching experience including the allocation of credit and blame, the effect of hearsay on survival instincts, and the desirable attributes of a mathematics teacher. A transcribed copy of one of the three interviews conducted after the second practicum may be found in Appendix D.

One interview was conducted with Dr. Jones, the instructor of the mathematics methods course. This interview was used to determine the content taught during the mathematics methods course. This content was compared with what student teachers reported using in their practicums in order to determine what concepts transferred from the methods course to the teaching practicum. A transcribed copy of that taped interview may be found in Appendix E.

CHAPTER FIVE

Interpretation of the Data

As student teachers make the journey that progressively leads them toward becoming a teacher, there is an infinite number of steps and stages which must be achieved. Within this series of steps lies the mathematics methods course and student teaching experience (see Figure 2). It is this particular period of the student teacher´s development which is of primary importance to the present study. Thus, in interpreting the data, consideration will be given to defining the content in the mathematics methods curriculum, the nature of the student teaching experience, and the transfer which occurs between the methods course and student teaching practicum.

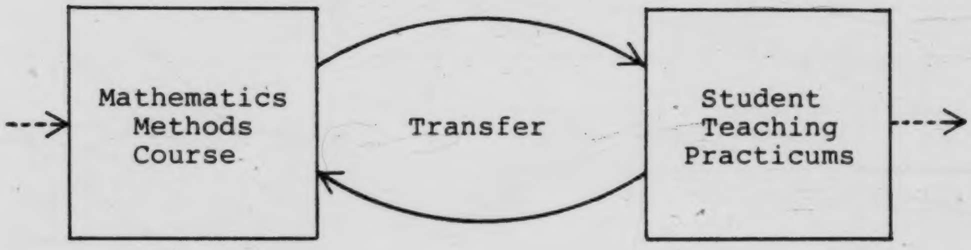


Figure 2: The process of becoming a teacher.

THE MATHEMATICS METHODS COURSE

The mathematics methods course which Dr. Jones taught is comprised of three smaller linked courses. These courses are officially numbered EdCI 364, EdCI 365, and EdPR 354 (see Figure 3). The EdCI 364 course focuses on instructional methods in junior high mathematics while EdCI 365 focuses on instructional methods in senior high mathematics. The EdPR 354 course is an on-campus practicum.

The EdCI 364 course (see Figure 4) was taught for the three weeks prior to the junior high teaching practicum. It occupied three hours each morning. The three hour morning block was split into two approximately equal sections. In the first section, Dr. Jones lectured on topics from the junior high mathematics curriculum. The concepts, terminology and some teaching strategies associated with each major topic in each grade level was discussed. The topics listed in the course outline (see Appendix G) include: whole numbers, rational numbers, ratio and proportion, integers, graphing, measurement, geometry, and algebra. According to Dr. Jones:

> DR. JONES: In the 364 course, the content that we looked at were the sets of whole numbers, rationals, ratio and proportions, integers, graphing, and so on, with algebra and geometry receiving the greatest emphasis. In each of those areas my intent was not to give the curricular dimensions of these strands. That is, I assumed that each school develops its own programs for whatever reasons, so that the main focus is instructional considerations or pedagogical considerations. In every case we went over different approaches to teaching and

Figure 3: The structure of the integrated professional term.

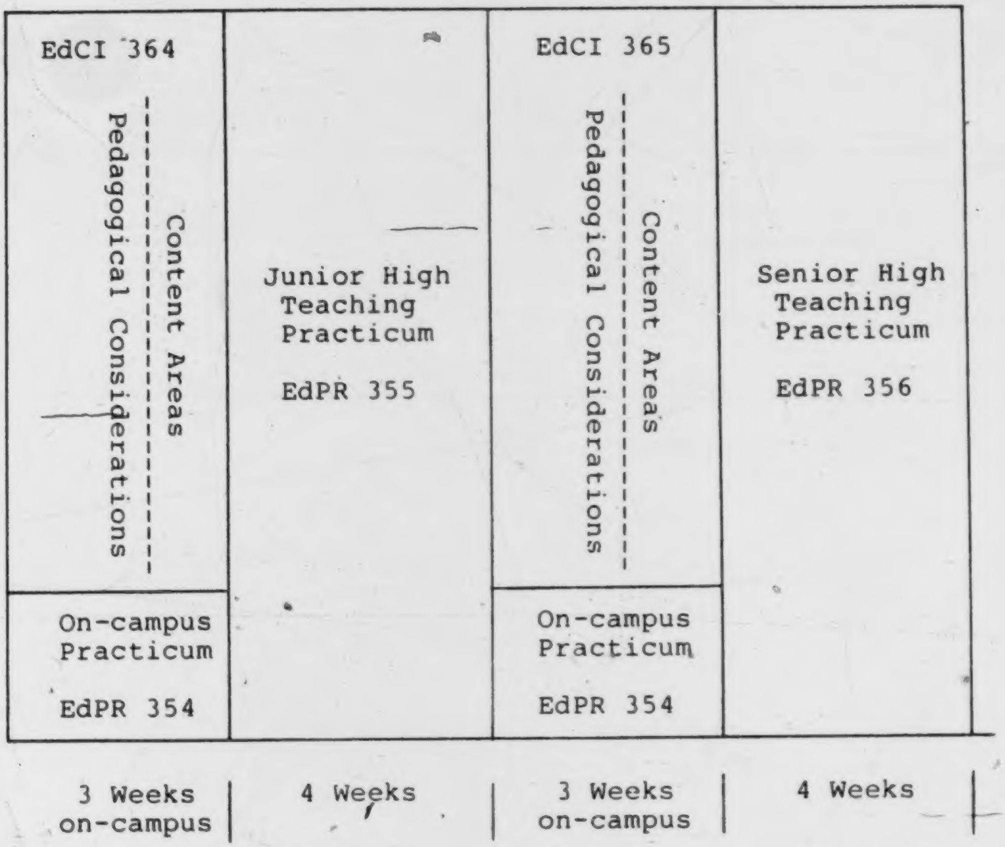
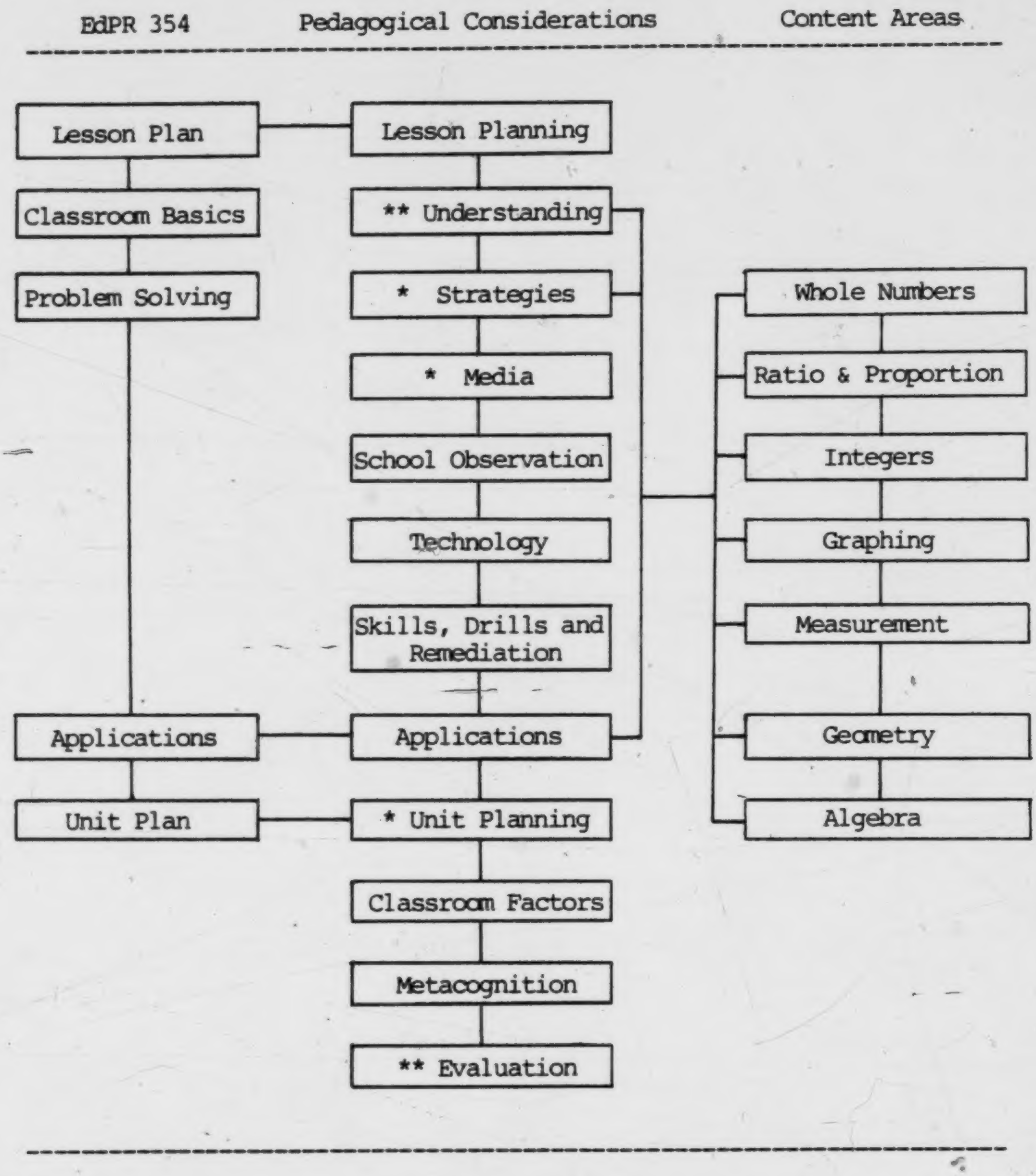


Figure 4: Structure of the EdCI 364 course.



* Assignments used for evaluation and to link to teaching practicum.
** Assignment here was based on testing for understanding.

> different ideas that can be used in teaching, some emphasis on terminology that they might not be familiar with (and there's quite a bit of terminology in some of these chapters, the pros and cons of using different terminology) and just to alert them to the fact that there might be different kinds of terminology that they will come up against.

Both Dr. Jones (see Appendix E) and the interviewed preservice teachers admit that the discussion of the mathematics curriculum was very general in nature.

> SUSAN: He divided the course into two halves. Half the course was to address curriculum while the other was to address pedagogical concerns such as teaching methods. I think he stressed the curriculum, but in a very general way.

The purpose of this session was to familiarize the students, in a general way, with the junior high mathematics curriculum.

The second half of the morning sessions was devoted to the pedagogical considerations. The pedagogical considerations are the educational issues, skills and knowledge which Dr. Jones felt were important to aspiring mathematics teachers. The topics included in this portion of the EdCI 364 course included: lesson planning, understanding, strategies, media, school observations, technology, skills, drills and remediation, applications, unit planning, classroom factors, metacognition, and evaluation. These topics represented the key concepts in the EdCI 364 course and as such received the most emphasis. These topics served as the links among the content areas as well as between the content areas and the EdPR 354 afternoon sessions.

The three pedagogical considerations which received most attention were understanding, strategies and applications. These three topics were covered with respect to each division within the content areas. For example, Dr. Jones stated: "One of the concepts that I used for dealing with the [mathematics] content is the notion of strategies". Dr. Jones linked understanding to strategies when he stated that "...the strategies and understanding [are] the basis of all mathematics learning (or at least that´s my interpretation of what mathematics learning is)...That´s the starting point from which we operate". He later stated that "Another topic is applications and the role of applications...I guess this is part of the content analysis. As we´re dealing with geometry we ask ´What are the applications of geometry?´". Strategies, understanding and applications were the focus by which the content areas were studied.

Such an obvious link was not drawn between the other pedagogical considerations and the content area studies. In the discussion of lesson planning a complex format was introduced which the student teachers could employ in their student teaching. In the media section of the pedagogical considerations, the preservice teachers looked at seventeen different media devices including textbooks, blackboards, overheads, notebooks and film. Special emphasis was given to the blackboard and the overhead projector. The section on technology covered uses of computers and calculators in the mathematics classroom. This section was de-emphasized. According to Dr. Jones "I really down-played the computer in this course; it's just not very important". The section on skills, drills and remediation was included because "the emphasis is so much on drill in the junior high classroom." Discussion in this section centered on mnemonic devices and on how to make practice effective. Unit planning received more emphasis than most other pedagogical considerations. This section stressed the notion of continuity and the tying together of lessons into a larger package. Two assignments were given on unit planning, one each during the junior high practicum and the senior high practicum. One session on school observation was provided before the preservice teachers went out to meet their cooperating teachers. The preservice teachers were given some suggestions of things to look for and some discussion took place regarding the degree to which student teachers must emulate their cooperating teachers. A guest lecturer, Frank Gibson, attended class one day to talk about metacognition. The talk focused on "the relationship between achievement, proficiency, and understanding. That is, being able to do mathematics, being able to do it without thinking, and understanding why the thing works--those three components" (Dr. Jones). One session each was spent on discovery teaching and classroom factors. The discovery teaching session was intended to pursue some "open approaches to teaching " (Dr. Jones) while the classroom factors session covered some managerial aspects of the mathematics classroom. In the latter session such topics as discipline, assigning homework, marking homework, questioning strategies and efficient teaching were addressed. The final topic, evaluation, was allotted two sessions to cover types of test questions and the difference between testing for understanding and testing for achievement. The evaluation section contained one assignment. There was a total of twelve different concepts which comprised the pedagogical considerations portion of the morning sessions.

The afternoon sessions (approximately two hours twice a week) comprised the EdPR 354 course. The goals of this course were to increase the involvement of the preservice teachers through discussions and applications of the content covered in the morning sessions, and to help the preservice teachers become better acquainted with their faculty consultants. Susan described the nature of the afternoon sessions:

> SUSAN: We...had afternoon sessions--two different afternoons. The sessions with Dr. Jones dealt with pedagogical concerns and were run like workshops. For example, the first week we talked about classroom basics. Dr. Jones would start the discussion and then get ideas from the class, so these sessions required more class participation rather than lecture.
>
> INTERVIEWER: Tell me about the other afternoon sessions.
>
> SUSAN: These sessions were run by the faculty consultants. In one session we discussed prepared lessons and described how we would present it. In the

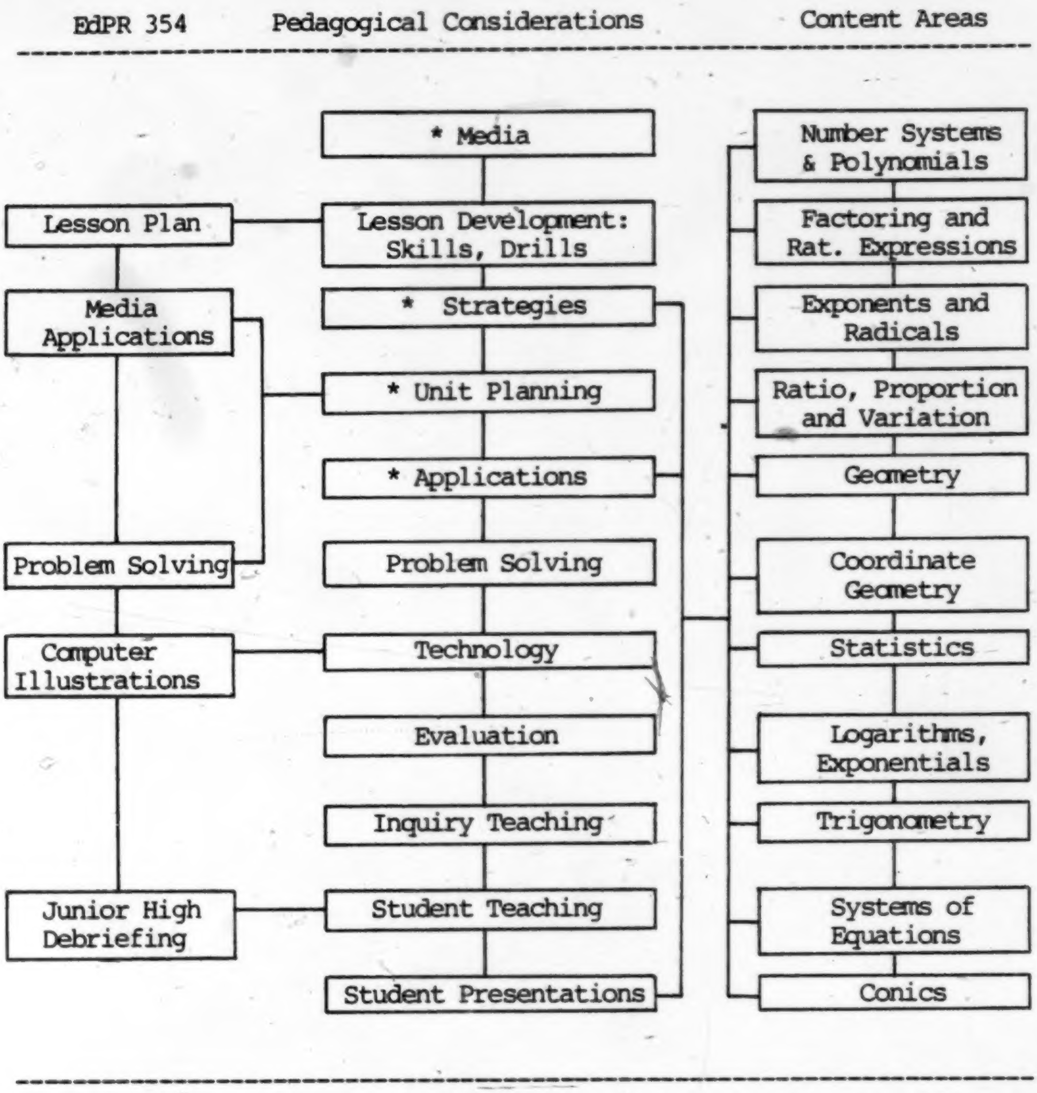
> second session, the one that I thought was most beneficial, we talked about unit plans. We had to prepare a unit plan and then lead the other members of our group through it step by step. Last week, we had to teach a lesson to our peers.

The EdCI 365 course (see Figure 5) was very similar to the EdCI 364 class. According to Dr. Jones:

> DR. JONES: ...In the second course, 365, we use exactly the same format with the content being dealt with in the morning and then these pedagogical considerations being dealt with in the afternoon. Basically, the pedagogical considerations are identical to those in the first course, it´s just that we go into them in greater detail and emphasize different things. One of the things I do in the second course is, when we´re talking about these same pedagogical considerations, I try to use some of the experience they´ve had in the first round to say "Now what have you learned about using the blackboard, or about using the overhead, or about using a notebook, or about using the text? What are the different ways you can use the text?", and so on. So, in our media lecture in the second part I ask them to contribute more of their ideas.

It is clear that there were only a few major differences between the EdCI 364 and 365 classes. These differences included the depth to which the pedagogical considerations were covered and the grade level of the mathematics content matter. The students had a greater participatory role in the 365 course. This participatory role was achieved by having students give ten to fifteen minute presentations pertaining to applications in each of the mathematics content areas. Dr. Jones commented that these presentations increased involvement, provided many good ideas, provided encouragement to the preservice teachers, and provided an opportunity for preservice teachers to try out their ideas. Other

Figure 5: Structure of the EdCI 365 course.



* Assignments used for evaluation and to link to teaching practicum.

differences Dr. Jones noted include: the decreased time spent discussing teaching strategies, and the introduction of problem solving and inquiry teaching. Neither topic was given strong emphasis.

The afternoon session (which comprised the on-campus practicum, EdPR 354) ran concurrent with the EdCI 365 course. The EdPR 354 course included five topics: a junior high debriefing, computer illustrations, media applications, and exercises in lesson planning, and lesson presentation. In the junior high debriefing session, the preservice teachers were encouraged to talk about their student teaching experiences and identify what knowledge could be brought to bear on the senior high practicum. In the computer applications session, the preservice teachers were shown several computer programs which could be used during instruction. The media applications session was spent discussing materials the preservice teachers had prepared for their senior high student teaching round. The lesson planning sessions were spent with the faculty consultants. In one session the student teachers taught a lesson that they had prepared based on some mathematical concept or procedure while in the second session the preservice teachers presented a lesson with the intent of describing why each element of the lesson was included. These five topics, one in each session, constituted the EdPR 354 on-campus practicum course.

THE STUDENT TEACHING EXPERIENCE

The critical incidents that the student teachers reported during their practicum described the nature of the student teaching experience. The findings are described for each of the following: differences resulting from the age of student taught, gender differences in student teaching, differences resulting from prior study, and differences in teaching perceptions occurring over time.

Differences Resulting from the Age of Student Taught

Instances of successful teaching (see Table 3 and Table 4 on pages 75 and 76) in the junior high school include Teaching Methods (52.6%), Discipline (36.8%) and Student Acceptance of Teaching Role (31.6%). To the student teachers it appears that successful teaching of junior high students entails being able to give clear examples and illustrations, being able to maintain order within the classroom, and being seen as a teacher by the students. The most common instances of successful teaching in the senior high include Motivating Students (46.7%), Student Acceptance of Teaching Role (46.7%) and Teaching Methods (40.0%). To the student teachers it appears that successful teaching of senior high students means being able to interest students in the study of mathematics, being seen as a teacher by the students, and being able to provide clear illustrations and examples during lecture presentations.

Discipline in the junior high school is an issue of primary concern. This can be illustrated in a comment made by Troy.

> INTERVIEWER: What teaching skills did you get the most practice at?
>
> TROY: In junior high, the main practice that I received was with discipline, definitely. As a student teacher, the whole concept of discipline kind of scares you, but you have to assume responsibility for what goes on in the classroom. It seems that junior high students are at a difficult age and they are out to test you. You really have to assume control. Some times I was wondering if I was babysitting or teaching. It was difficult, no doubt, but I really got a lot of practice at it.

To this student teacher, the primary skill that he developed when teaching in the junior high was learning to discipline students. Another student teacher comments that "...I tended to have more discipline problems in the junior high than I did in high school" (Sheila). This may explain why discipline is a source of successful teaching in the junior high while it is not in the senior high. That successful teaching in the senior high school results from motivating students is attributable to the fact that senior high students are made more accountable for their own learning. Consider this quote from Sheila:

> INTERVIEWER: How well did you enjoy your senior high student teaching experience? Why?
>
> SHEILA: I would say that I enjoyed it more than my junior high round. There was not as much responsibility that you as the teacher have to take. You're not as responsible for the students as you would be in the junior high. You make them responsible for the learning; you're not continually nagging them.

It is a natural consequence of placing the responsibility for learning on the students that these students must in turn be well motivated. Another explanation of this phenomenon may be that some student teachers see high school students as requiring more motivation. Bertrand comments on the difference between senior high and junior high students:

> BERTRAND: One of the nasty differences is that high school students are far less excitable than junior high students. It was quite easy to get junior high students excited about something, working on something, anxious to please me with their work, whereas high school students did their work, checked their work, went on to the next thing without showing any real feelings at all.

Instances of unsuccessful student teaching in the junior high include Discipline (52.6%), and Planning and Preparation (26.3%). Mathematics preservice teachers find that the primary source of nonsuccessful teaching experiences is the inability to deal with misbehavior from junior high students. In fact, twice as many student teachers report Discipline than the next highest problem area. Instances of nonsuccessful teaching in the senior high come from three sources: Teaching Methods (50.0%), Discipline (28.6%), and Planning and Preparation (28.6%). This indicates that the trend established in the junior high of concern for Discipline and Planning and Preparation continues through to the senior high, but there is a large increase in concern for providing clear examples and illustrations (Teaching Methods). Apparently Discipline and Planning and Preparation remain important issues regardless of the age of the students.

That preservice teachers are concerned with providing good examples and illustrations (Teaching Methods) is probably a function of teaching more difficult material. Darren comments that the difficulty of the material in the senior high (and the length of time since he studied the material himself) is a worry for him:

> DARREN: I am concerned about having a really good grasp on the subject area, because some of the subject I haven´t done for ten years. It is important to have a good grasp on this so that I can answer their questions and get the material across to them.

When student teachers encounter nonsuccessful incidents in the junior high, there tends to be a downward shift (see Figure 6) across the stages (as defined by Campbell and Wheatley, 1986). These data imply that when preservice mathematics teachers encounter nonsuccessful teaching incidents in the junior high, it causes them to question their own adequacy and competence. The same trend does not exist in the senior high data. When preservice teachers encounter nonsuccessful experiences in the senior high, there tends to be a middle shift, that is, there is a shift downward from stage three to stage two and upward from stage one to stage two (see Figure 7). This trend could be due to an emphasis that is placed on the stage two concepts and skills within the methods course or from the experience gained while student teaching in the junior high school. The level of experience may effect how student teachers react to

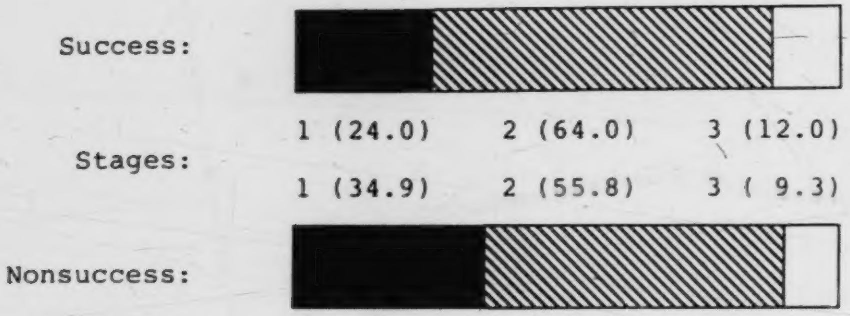


Figure 6: Percentage of critical incidents at each stage reported during the Junior High practicum

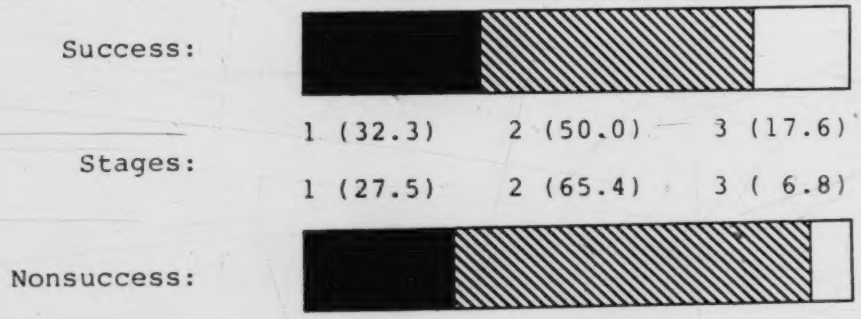


Figure 7: Percentage of critical incidents at each stage reported during the Senior High practicum

nonsuccessful experiences. Consider this comment made by one student teacher:

> INTERVIEWER: Why would student teachers accept the blame (for the bad things that happen) themselves?
>
> BERTRAND: Because we're inexperienced, we don't know anything. Things worked well before we got there, why shouldn't they work well while we're there? Because we don't know, we tend to assume everything was rosy before we got there.

Gender Differences in Student Teaching

The most common instances of successful teaching (see Tables 5 and 6 on pages 77 and 78) for female student teachers (tabulated by combining data from both practicums) are: Discipline (61.5%), Teaching Methods (53.8%), Student Acceptance of Teaching Role (46.2%), and Motivating Students (38.5%). For males the most commonly reported instances are: Student Acceptance of Teaching Role (57.1%), Teaching Methods (57.1%), Discipline (42.9%), and Motivating Students (42.9%). The same four categories apparently provide instances of successful teaching for both females and males, but females seem to be more sensitive to instances of effective discipline than are ~~males~~. Males appear slightly more sensitive to being accepted as a teacher (Student Acceptance of Teaching Role) than females. One student teacher comments:

> BERTRAND: I do find adolescent pressures being heaped on me by the students. It's absolutely ridiculous. They want to know what kind of car I drive, am I married, do I see lots of girls, what do I do in my spare time, do I go to heavy metal concerts. It's ridiculous, but the thing

> is that I do feel the pressure too. Somehow I want to be an acceptable adolescent male. This is really absurd, because when I´m away from school I have no desire to be one.

Though both males and females desire to be accepted by the students they teach, it is slightly more sharply felt by males. Any differences between males and females in instances of successful teaching are differences of degree, not kind.

Instances of nonsuccessful teaching are very different for males and females. The most commonly reported nonsuccessful critical incidents for females are: Planning and Preparation (58.3%), Discipline (50.0%), and Student Acceptance of Teaching Role (41.7%). Males report the following as the most common sources of nonsuccessful teaching: Discipline (85.7%), and Teaching Methods (71.4%). It would appear that females encounter their greatest student teaching difficulties in planning and preparing materials, being accepted by the students and in an inability to adequately deal with discipline problems. Males encounter their greatest difficulties in being unable to discipline students or present clear lessons with good examples and illustrations. It should be noted that fewer females than males report instances of ineffective discipline, but those that do report it, do so more frequently (i.e., the reporting of discipline problems is more localized in females than males: females - %A is 50.0%, %B is 30.8%; males - %A is

85.7%, %B is 29.6%). These data imply that fewer female preservice teachers struggle with discipline problems, but those that do sense it more sharply. The same may be said of nonsuccessful teaching methods. A significantly lower percentage (A) of female student teachers report the use of ineffective examples and illustrations, but those that do, do so more often (i.e., the reporting of Teaching Method difficulties is more localized in females than males: females - A% is 25.0%, %B is 17.9%; males - %A is 71.4%, %B is 25.9%).

A higher percentage (A) of females than males report Planning and Preparation as a source of nonsuccessful teaching incidents (females - 58.3%; males 14.3%). This implies that females see lesson and unit planning as well as test construction as a more integral part of teaching. When Anne and Sheila were asked "What are the most important skills or attributes a mathematics teacher should have? and Why?", they responded:

> ANNE: I think the most important skill is organization. I found this to be a problem. I think that it is really a very important quality that a teacher should have in order to teach well.
>
> SHEILA: Being organized. Have a lesson plan. Have your overheads done ahead of time. Go through what you are going to teach so that you can anticipate what types of questions they might ask, and ask them to yourself. And, work out the little errors in your lesson plan.

Males too sense the necessity of planning, as may be seen in the interview with Bertrand.

> BERTRAND: I think Planning and Preparation is important as was driven home yesterday dividing polynomials, not picking a good example and winding up with all kinds of nasty fractions which terrified the students far more than the math skills I was trying to teach. So I think adequate preparation is very important.

Males, according to the trend in the data, tend to be more concerned with the content of the lesson plan (Teaching Methods: females - 25.0%; males - 71.4%) than with the form in which it is constructed (Planning and Preparation: females - 58.3%; males - 14.3%).

Two general trends also arise when comparing instances of successful and nonsuccessful student teaching between males and females. In instances of successful teaching, females tend to reside at higher stages than males (see Figure 8). When females encounter nonsuccessful teaching instances, they tend to be pulled downward toward stage one (see Figure 9) while males shift upwards to stage two (see Figure 10). These data may be accounted for in either of two ways. First, it may be argued that as females tend to begin at a higher stage (stage two), they have more to lose when encountering nonsuccessful teaching instances (by dropping to stage one), but this does not explain why males would shift from stage one to stage two. Second, when females encounter unsuccessful teaching instances, they retreat to stage one concerns while males focus on stage two concerns.

The second general trend is that females and males seem to be approximately equal in stage three concern for learning

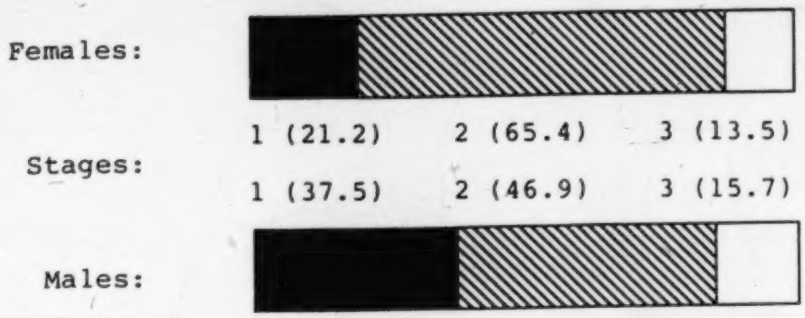


Figure 8: Comparison of success critical incidents at each stage reported by females and males

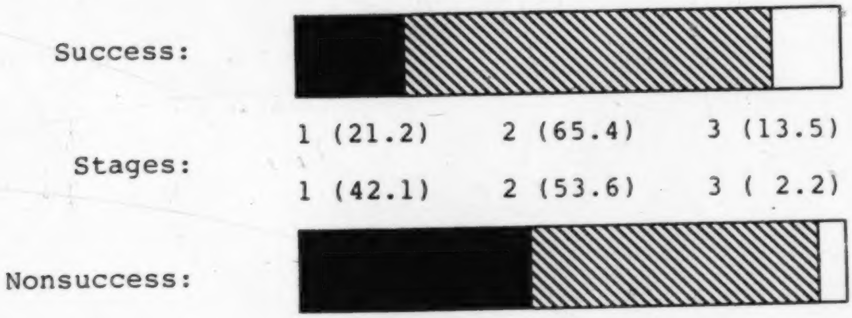


Figure 9: Percentage of critical incidents at each stage reported by females

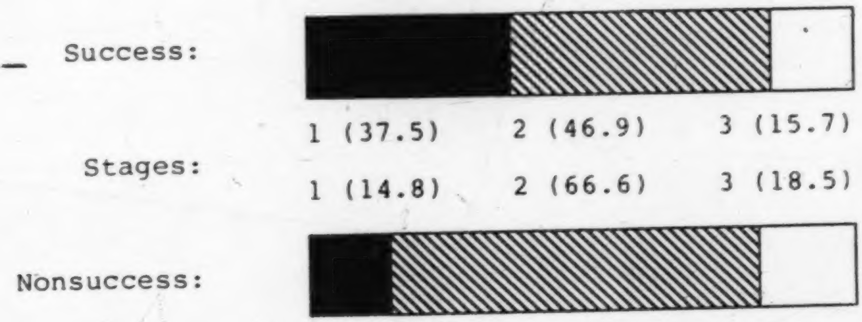


Figure 10: Percentage of critical incidents at each stage reported by males

in instances of successful teaching (stage three %C: females - 13.5%; males - 15.7%), but males are more likely to label a lesson as being nonsuccessful if the students have not met the lesson's objective (stage three %C: females - 2.2%; males - 18.5%). In general, males tend to be slightly more aware when students fail to meet objectives; however, neither males nor females commonly report concern for student learning in either instances of successful or nonsuccessful student teaching.

Differences Resulting From Prior Study

Instances of successful student teaching (see Tables 7 and 8 on pages 79 and 80) for preservice teachers for whom their undergraduate education degree is a first degree include: Teaching Methods (54.5%), Discipline (54.5%) and Student Acceptance of Teaching Role (36.4%). To these student teachers successful teaching means being able to provide good examples and illustrations when in front of the class, being able to maintain discipline within the classroom, and being accepted as a teacher by their students. Instances of successful student teaching for those preservice teachers who are after degree students include: Student Acceptance of Teaching Role (66.7%), Discipline (66.7%), Teaching Methods (55.6%), and Motivating Students (55.6%). To student teachers completing a second degree, successful teaching means being accepted as a teacher, being able to discipline students, being able to provide good examples and illustrations while lecturing, and being able to motivate and interest students in mathematical studies. After degree students experience nearly identical instances of successful teaching as do first degree students except after degree students also sense success when they are able to motivate their students. The use of good examples and illustrations (Teaching Methods) is a prime source of successful teaching for an approximately equal percentage of first degree (54.5%) and after degree (55.6%) student teachers, but it is reported more often by first degree student teachers (%B: first degree - 30.0%; after degree - 18.4%). This trend may illustrate a greater interest in finding good examples and may be a product of a lesser degree of mastery in the mathematics discipline.

Instances of nonsuccessful student teaching among first degree students include: Planning and Preparation (50.0%), Discipline (50.0%) and Teaching Methods (40.0%). To these student teachers the primary source of nonsuccessful teaching is the inability to plan lessons, predict areas of student difficulty and plan appropriate amounts of material, maintain disciplinary control in the classroom, and provide good illustrations and explanations to students. Instances of nonsuccessful student teaching among after degree students includes: discipline (75.0%), Teaching Methods (50.0%) and Planning and Preparation (37.5%). These nonsuccessful incidents represent the same sources of difficulty for after degree students as were evidenced for first degree students. If any differences exist between the two groups, it is with respect to the frequency with which they are experienced. First degree students more commonly experience difficulty with their planning and preparation. This may be a function of the degree of understanding and knowledge of the subject matter. One student teacher comments:

> SHEILA: A previous degree wouldn´t hurt. I´ll put it to you that way...The difference that it makes is that you have much more background information...It will help you, the teacher, become more competent. If you have a degree in [math] you should know what is going on...

It should be noted that after degree students also sense the difficulties of planning and preparation, as can be seen through the discussion with Anne:

> INTERVIEWER: When you were student teaching in a senior high classroom, what things did you worry about the most? Why?
>
> ANNE: Before getting up there, how prepared I was.
>
> INTERVIEWER: What do you mean by being prepared?
>
> ANNE: Being able to handle questions. I have a good mathematics background, and I thought I knew the mathematics cold, but every now and then you get a question that you haven´t a clue how to answer. After you get a few of them you start to worry a bit...

Later in the interview Anne comments:

> ANNE: I haven´t gone through education without a degree so it´s hard for me to see both sides of the issue, but I firmly believe a B. Ed. after degree should be the only degree available from this faculty.
>
> INTERVIEWER: You commented though that you too worried about your mathematical knowledge.

> ANNE: Yes, but it´s tough. It´s a matter of having to go back and relearn what I learned back then. You learn a lot of short cuts and knowledge that you have built upon. For example, working with fractions. The grade tens are hopeless with them and I began to wonder what was wrong but then I realized that it´s just easy for me because I´ve had so much more experience with it. In a way having a degree does detract, but overall it´s to your advantage.

Though it is apparent that both first degree and after degree student teachers struggle with preparing the mathematics curriculum for instruction, it is apparent that after degree students sense this difficulty slightly less frequently.

A greater percentage of after degree student teachers (75.0%) than first degree student teachers (50.0%) report discipline as a source of nonsuccessful teaching. This may be a product of the expectations with which these preservice teachers enter into the classroom. Because after degree students are probably more interested and motivated in the pure mathematics discipline, they may also expect the same of their students. Instead, these student teachers find that the students are not interested and this disinterest may be manifested in misbehavior. Other than the differences in frequency of occurrence, the types of nonsuccessful critical incidents experienced by first degree and after degree student teachers are identical.

Five general trends are evidenced in this data. First, after degree students (66.7%) are significantly more sensitive to being seen as a teacher than are first degree students (36.4%). Second, first degree students (30.0%) report feelings of self doubt (Self Acceptance of Teaching Role) more frequently than do after degree students (0.0%) when encountering instances of nonsuccessful teaching. Third, first degree student teachers experience a shift downward toward lower stages when encountering instances of nonsuccessful teaching (see Figure 11). After degree student teachers indicate a shift upward toward stage two (see Figure 12). This trend may imply that after degree student teachers have a greater ability to learn from their mistakes. After degree student teachers may be better able to cope with the stress of nonsuccessful teaching instances. Fourth, first degree students tend to be more receptive to student learning in both successful (C%: first degree 20.0%; after degree - 7.5%) and nonsuccessful (C%: first degree - 12.8%; after degree - 3.1%) teaching instances. This may be a consequence of having come from high school more recently or of the personality type of the person that moves directly into studies in education. Consider this comment from Bertrand when asked why this phenomenon might exist:

> BERTRAND: ...I think it´s partly a personal thing because some people are more social than others and are more interested in the students´ well-being, and that might be the sort of person who from the outset might want to go into education as opposed to the person who might see it as an after-thought or an extension.

Fifth, there is no evidence in this study to show that either a first degree or after degree program has any marked

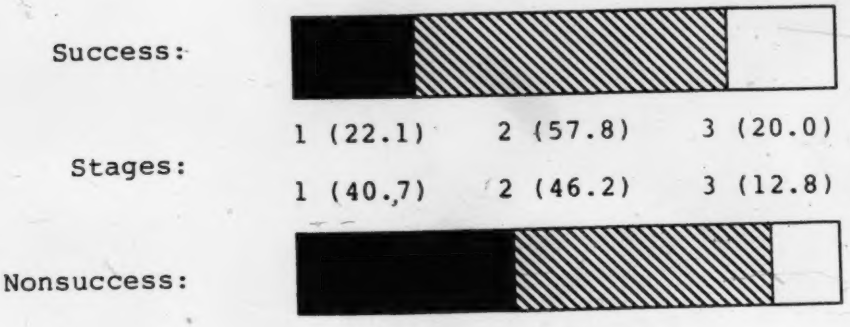


Figure 11: Percentage of critical incidents at each stage reported by students completing a first degree

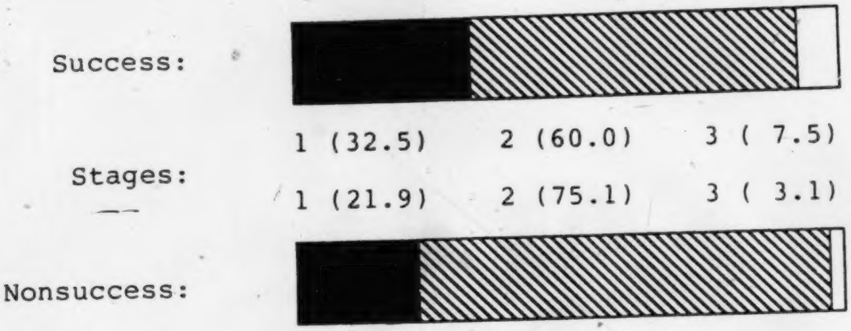


Figure 12: Percentage of critical incidents at each stage reported by after degree students

advantage over the other. Consider Susan´s response when asked the question "Do you think it would help to have a previous degree and then get an education degree? What difference would it make?":

> SUSAN: I´m not sure that I can answer the question with a yes or no. But I do think that if you have a previous degree then you do have more background knowledge especially if your degree relates to your education degree. On the other hand, I don´t think it´s important to have a degree before you go into education. A previous degree may give you a lot of knowledge, but it doesn´t necessarily help with teaching methods and communication. The knowledge may be present, but a teacher needs to go one step further.

Differences in Teaching Perceptions Occurring Over Time

For the purposes of this discussion, the early term refers to the time period from January 26 to February 9, while the middle term refers to the time period between February 10 and April 5, and the late term refers to the time period between April 6 and April 24.

Instances of successful teaching (see Tables 9, 10 and 11 on pages 81, 82 and 83) during the early term result from Teaching Methods (50.0%), providing good examples and illustrations while lecturing. During the middle term the source of successful teaching instances is Student Acceptance of Teaching Role (61.5%). There are four sources of successful teaching during the late term: Student Acceptance of Teaching Role (41.7%), Teaching Methods (41.7%), Discipline (33.3%), and Motivating Students (33.3%). This implies that during the middle term successful teaching means being accepted as a teacher, while in the late term it means being accepted as a teacher, employing good explanations and illustrations in lectures, being able to successfully resolve behavior problems, and being able to interest students in the study of mathematics.

It should be noted that concern for Discipline (%A: Early - 7.1%; Middle - 23.1%; Late - 33.3%) and Motivating Students (%A: Early - 7.1%; Middle - 23.1%; Late - 33.3%) show consistent and equal growth across the terms while concern over Classroom Environment (%A: Early - 14.3%; Middle - 7.7%; Late - 0.0%) and Work Accomplishment (%A: Early - 21.4%; Middle 7.7%; Late - 0.0%) show a marked decline to the point that the students no longer report them as a source of successful teaching. This decline may occur as student teachers come to realize that they are being evaluated primarily on their ability to motivate and discipline students, not necessarily on the amount or quality of the work that the students accomplish. That concern for Classroom Environment fades is not surprising as it is not initially a commonly reported source of successful teaching.

Being accepted as a teacher (Student Acceptance of Teaching Role) remains a strong source of successful teaching at both the middle (61.5%) and late (41.7%) terms. The middle term contains the first week of the senior high placement while the late term occurs within the senior high placement. Therefore, it is when working with senior high students that student teachers most commonly report Student Acceptance of Teaching Role as a source of successful teaching instances. This trend may result from the small age difference between the student teachers and their students during the senior high practicum.

An interesting trend that arises from the success critical incidents is that the student teachers initially enter their practicum with a concern for their classroom capabilities, a stage two concern (see Figure 13). During the middle time period, there is an increase in concern for self adequacy and competence, a stage one concern. In the late time period, there is again a growth into stage two, but this time the student teachers are more concerned with a broader range of issues. This implies that student teachers enter into their student teaching round anxious to try out and experiment with their newly acquired teaching techniques and strategies only to end up sensing greater benefit from being accepted as a teacher. As these students gradually emerge again from stage one they are able to better understand the necessity for interest in the entire range of classroom concerns (stage two). Another explanation of this trend could be that when student teachers enter the second practicum they do regress to wondering if they will be accepted or appear adequate in their new placement. Anne describes her experience:

ANNE: I approached my first found of student teaching

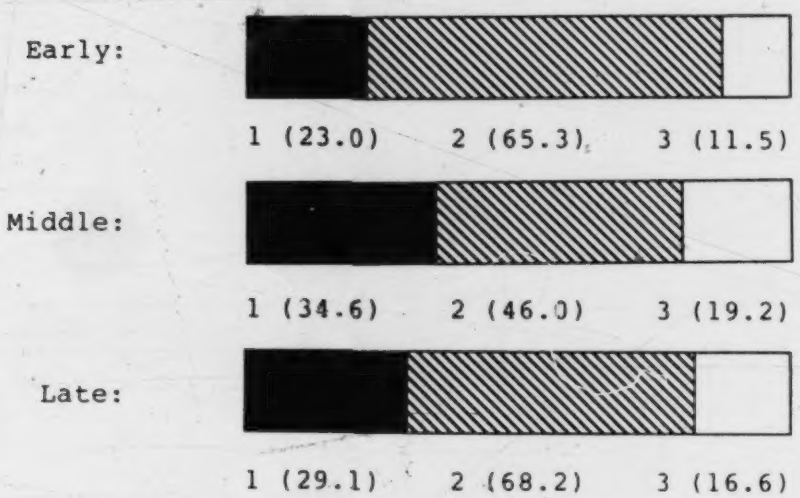


Figure 13: Comparison of success critical incidents reported during early, middle and late time periods

> with absolute terror. This was the first time I had been teaching. I hadn´t even been thinking about teaching for three or four months. And here I am being thrown in front of a class. I was frightened to death. It went great and I had a great time with these kids, and I learned a lot and had an excellent experience. But throughout the whole thing, even part way through, I was still frightened to death. Afterwards, approaching my next round, even though I had this great experience behind me, I experienced fear again. It was a whole new situation, a new set of rules, another school to get used to, another cooperating teacher to develop a relationship with. The way that things change from round to round, you´re always sent back to level one. Whatever positive feelings you have toward your student teaching at the end of one round, you´re not very likely to carry that into the next because everything is changed...These are very difficult times to get through.

In the early term, nonsuccessful teaching instances include: Planning and Preparation (36.4%), Teaching Methods (27.3%) and Discipline (27.3%). In the middle term nonsuccessful teaching instances arise from being unable to resolve Discipline problems (43.8%). In the late term nonsuccessful teaching instances are a function of Teaching Methods (46.2%) and Discipline (30.8%). These data show that discipline remains a key concern across each time period (though it is most profound in the latter part of the junior high practicum), but concerns for Planning and Preparation are quickly overcome as student teachers find a mode of planning which is effective for them (or adopt the cooperating teacher´s style). Teaching Methods remains relatively important in each time period as well (early - 27.3%; middle - 18.8%; late - 46.2%) but is most profound in the late term when the student teachers are in their senior high practicum. That Planning and Preparation makes a resurgence from the middle term (12.5%) to the late term (23.1%) is probably due to the fact that the student teachers are struggling with a new and more difficult content.

In general, these data show that student teachers, during their eight week practicum, may be able to progress from stage one concerns for self adequacy and competence to stage two concerns for classroom skills, but there is little or no consistent growth to stage three concerns for student learning. For most student teachers, their primary concern throughout the three terms relates to the skills and issues associated with stage two. The only exception occurs in the nonsuccessful teaching incidents during the early term when primary emphasis is placed on stage one concerns for Planning and Preparation. The lack of growth to stage three concerns is consistent with the findings of Fuller (1969), Campbell and Wheatley (1983), and Schempp (1983).

The interviews that were conducted with the six student teachers gave rise to three phenomena: the need for students to allocate credit and blame for successful and nonsuccessful teaching instances, the relationship between the transmission of rumors and the interference of survival instincts, and the student teacher's perceptions of what constitutes good mathematics teaching. Each of these phenomena are now considered.

Allocating Blame and Credit

As the critical incidence forms were read through and coded, it was noticed that student teachers tended to take the blame for themselves in unsuccessful teaching instances yet share the credit in successful teaching instances. This finding is consistent with the results reported by Placek and Dodds (in press). The following are examples from among the critical incidence forms collected:

> SUCCESS INCIDENT #1: The students received their tests back on the previous chapter and were feeling very conscientious. This made for a very attentive class and one student, in particular, who I had been having trouble with in terms of attitude, thanked me for helping her with the concept. Previous to this period she had always been critical of my discipline and methods. The chapter test forced the students to take things more seriously. (Coded: Student Acceptance of Teaching Role).

> SUCCESS INCIDENT #2: This was the first introduction of motion problems using acceleration due to gravity. The students have used the motion equations before, but haven´t learned anything about the earth´s gravitational field yet. This lesson went very well. The students were interested in the reasons for acceleration, and the measurement of acceleration due to gravity. The fact that the students were familiar with the motion equations enabled me to emphasize the meaning behind the problems. The students picked up some fairly complex problem solving strategies during this lesson. I was quite pleased with their response. (Coded: Student Motivation).

In both of these critical incident descriptions, the student teacher shared credit with the students for the successful incidents. In the first example the students contributed by being attentive, responsive, and respectful of their teacher. In the second example, the students were credited with demonstrating their prior learning and their interest. In both of these incidents, some credit was also taken by the student teachers. In the first incident the student teacher takes credit for the students rising to her expectations. In the second incident the student teacher takes credit for introducing certain key concepts and linking them to prior learnings to achieve a high degree of student motivation. In both examples, the student teachers have shared the credit for successful incidents between themselves and their students.

In nonsuccess critical incidents student teachers tend to accept blame. Consider the following nonsuccess examples:

> NONSUCCESS INCIDENT #1: We were covering equations of lines and I was going through some examples on the board. One group of students in the back kept heckling all through the class. I ignored most of it hoping it would extinguish the behavior. The behavior kept on through most of the lesson, disturbing others around them. I probably should have come down on them more to get them to quit and pay attention. They did not learn the material that day and two of them had to come in for extra help. (Coded: Discipline).
>
> NONSUCCESS INCIDENT #2: When presenting a lesson on rationalizing denominators, I assumed too much previous knowledge on the behalf of the students. My beginning examples were too difficult, and scared many of the students away from the easier problems. The first problems involved two or three simplifications. (Coded: Teaching Methods).

In these examples no responsibility for classroom behavior or learning is attributed to the students and full responsibility for each is shouldered by the student teachers. In the first example, the student teacher accepts blame for not acting sooner or more forcefully and in the second example the student teacher accepts blame for using inappropriate examples. It could be said that in the first example the students should be expected to be better behaved while in the second incident the students should be responsible for informing the teacher that they do not understand, and that more or different examples are necessary. In both examples the student teachers accepted the blame for the nonsuccessful teaching incidents themselves, it was not shared with the students.

As these trends became evident in the reading of the critical incident forms, it became necessary to ask the student teachers during interviews why this trend might exist. The following questions were part of each of the six interviews: When things go wrong in the classroom, whose fault is it? How about when things go well? Five of the six student teachers stated that the blame falls almost exclusively on the shoulders of the teacher. The remaining student teacher claimed that the blame could either be the students´ or the teacher´s, and this must be determined through reflection subsequent to the incident. Consider the comments made by Troy, Sheila and Anne:

> TROY: I think as the teacher you have to accept the responsibility for what goes on in the classroom. If things do get out of hand, it´s your fault. It´s easy to blame the students and say that "this is really a rowdy class" and they may misbehave regardless, but they will misbehave more if you let them. You are the one in control and you are the one who determines what is going

> to happen...You have to correct the minor problems and keep things going.
>
> SHEILA: I tend to blame myself when something goes wrong in a lesson. It depends on what went on in the classroom. If I have one student who is being a real hoser and is disrupting my class continually, and I´m trying my hardest, then there is no one that I can blame but him or her...But for the most part, when a lesson does not go well, or I have a lot of students asking me questions, I blame myself rather than someone else.
>
> ANNE: ...Where blame can be laid, 98% of the time it´s my fault.

The lone dissenter stated:

> DARREN: ...As teachers we have a lot of control over the classroom and whether the students are up or down. But the students have a lot of control too. So you have to evaluate whether it´s you controlling the situation...A lot of the pressure comes to me, but you have to watch the reason for it.

The six student teachers did not share such similar sentiment in the allocation of credit. Three student teachers clearly stated that credit must be shared with the students.

> SUSAN: ...When things go really well, I guess you´d like to think that it´s all to your credit, but if things go well then students are cooperating too and they´re helping things go well for you. The teacher is the leader, but there is a lot of interaction between the teacher and students, and so if things go well, it´s because there was good interaction between both.
>
> SHEILA: ...But if something does go great, if one of my lessons goes great, one of the first things I put down in my evaluation is that the students were well behaved, giving credit to them. I also note things that I did well so that I can do them again.
>
> DARREN: ...You look at it and decide why did it go well? It is important not to try and put all the blame on yourself for the bad days, and give all the credit to the students. You have to balance it out somehow.

Three student teachers clearly state that if the teacher must accept blame for nonsuccessful teaching incidents, then the teacher should take credit for successful teaching incidents. Consider the statements made by Troy, Bertrand and Anne when asked who should take credit for successful teaching incidents:

> TROY: You take the blame when bad things happen and things go wrong, I think you should also take the credit when things go well.
>
> BERTRAND: I think that´s [the positive events] also largely the teacher, or even the teacher of the last class.
>
> ANNE: ...It´s 98% my responsibility. The teacher should not rely on the students for excusing their teaching. I think the teacher is responsible for almost all of both [the successful and nonsuccessful teaching incidents].

When asked why student teachers accept blame and share credit, Sheila and Bertrand stated that it is a product of the inexperience of the student teacher:

> SHEILA: ...You do not have the experience of a real teacher, you are not a real teacher. And if something goes wrong, it´s not because the students didn´t try their hardest, it´s because you don´t know quite what you´re doing yet. This is a typical student teacher attitude.
>
> BERTRAND: ...As student teachers, we´re...very inexperienced and we´re often surprised when something goes extremely well, just as when something goes dismally wrong.

Anne stated that the reason student teachers accept blame and share credit may be attributed to low confidence and self-esteem:

> ANNE: I think that shows how confident we really are approaching the teaching situation. It reflects how

confident you are and your level of self-esteem.

It appears that some student teachers share credit with their students while others accept the majority of the credit for themselves for successful teaching incidents. This seems to be related to the type of events which occur within the classroom, the degree of teaching experience, and the confidence and self-esteem of the student teacher. It also appears that most student teachers accept blame for nonsuccessful teaching incidents without sharing responsibility for these incidents with their students.

Hearsay and Survival

Student teachers enter into their student teaching experience with certain expectations and preconceived notions with respect to how they will be treated by the students, the character of the students and the resultant effect both will have on their own behavior.

One major source through which preconceived notions are developed may be appropriately called the ´grapevine´. Anne´s past experiences and the rumors she had heard before her practicum began caused her to dread her senior high practicum. Anne described the source of her expectations:

> INTERVIEWER: What were you most looking forward to in the senior high student teaching round?
>
> ANNE: Nothing. I wasn´t looking forward to it at all. It was dread.
>
> INTERVIEWER: Why were you so afraid?

> ANNE: Because I had such a rotten experience last time. Another four weeks of this, I didn't know if I could handle it.
>
> INTERVIEWER: Did you think it would be the same as the round before?
>
> ANNE: Well, I had no idea. The school I went to was out in Brownville and there are three high schools there. There was a lot of rivalry and a lot of rumors about what went on in these schools and what the people were like in these other schools. It was baseless, but it was part of what I had grown up with.

Consider this excerpt from the interview with Sheila:

> INTERVIEWER: What were you most looking forward to in the senior high student teaching round?
>
> SHEILA: I had heard through the grapevine that it's not as hectic and you don't have to use as much energy in the senior high classroom as the junior high classroom. I was really looking forward to the difference that I could see between the classrooms and the independence that I could see with my students. The fact that I could give them responsibility and see how my teaching could adapt to that situation...

Earlier in the same interview Sheila commented that she placed more responsibility for learning on the shoulders of senior high students than she did with junior high students.

> INTERVIEWER: What is the major difference, if any, between teaching in the junior high school and the senior high school?
>
> SHEILA: To me in the junior high school, you're more of a person that's taking care of children. You're giving them some responsibility but not as much as you would in a senior high school. In the senior high school more responsibility should be placed on the students and the teacher should be there just to give the students the information. If they want to learn it, fine they learn; you can't force it down their throats...In high school you don't have to do as many entertaining things as you do in the junior high. Kids in junior high school are not as motivated toward school as are kids in the high school. This is due to the fact that by the time they get to high school the kids are there because they want

> to be there. In the junior high, you spend a lot more time motivating and trying to get the kids going on the subject.

It is not clear that hearing through ´the grapevine´ necessarily changed Sheila´s behavior toward her students, but it can at least be noted that it formed part of her expectations for the senior high practicum.

Bertrand and Susan both described expectations for student behavior while teaching in the high school. Bertrand expected his students to be more mature and able to learn more difficult mathematical concepts. Susan shared similar expectations but stated that she had further expectations in terms of student behavior.

> BERTRAND: I was mostly looking forward to slightly brighter students, or more mature students and being able to talk about some of the slightly more difficult conceptual aspects of mathematics rather than just teaching skills as you do in the junior high. I wanted to approach some of the more difficult questions.

> SUSAN: The senior high students are more mature; they can handle more responsibility and you don´t have to babysit them as much. There is less discipline necessary in the senior high school, or at least a different kind of discipline that is needed. I also think that it will be more challenging in terms of content material.

Neither Bertrand nor Susan commented on the source of their expectations although Susan commented at another time during her interview that one reference was her own junior high experience.

> INTERVIEWER: So your first round was in the senior high setting?

> SUSAN: Yes.

> INTERVIEWER: Which did you like better overall?
>
> SUSAN: Senior high, but junior high turned out not to be as bad as I thought.
>
> INTERVIEWER: When you say that it wasn´t as bad as you thought, what made you think it would be bad?
>
> SUSAN: I was just thinking back; I was just comparing to the school that I attended in junior high. I went to a very small [rural] school, and then when I taught up here I thought the kids would really give me a hard time. I thought I would have all these AC/DC type kids. My preconceived notion about junior high students was that they were going to be really mean to me.
>
> INTERVIEWER: Did you find it that way?
>
> SUSAN: No.

Some preconceived notions are confirmed during the practicum, and some are not confirmed. It is important to note that these preconceived notions and expectations do exist and can be a source of profound stress for the student teachers. Troy described his experience:

> INTERVIEWER: What did you like about teaching in the junior high?
>
> TROY: The main thing I liked about junior high was the kids. Going into the junior high I thought I´d never want to teach here. Coming out, I thought I wouldn´t mind at all. They have a high energy level and create a lot of involvement. I like the students at this age.
>
> INTERVIEWER: You have said that going into it, you didn´t think you´d like it. What made you think that way?
>
> TROY: You always hear the horror stories from teachers and from other student teachers who have been in junior high before. You hear that junior high students are the absolute worst to teach, lots of behavior problems, nobody would ever want to teach there, it´s a zoo, and by the time you end up going into the junior high class, you are basically scared. Your survival instinct comes up quickly. It´s sink or swim.

Preconceived notions are a source of anxiety for student teachers and may activate a survival instinct. This instinct may displace student teachers´ concern for their students´ learning. Bertrand was asked why student teachers rarely describe critical incidents about student learning.

> BERTRAND: I think part of the student teaching experience is survival. You have four week to go in, do something, and make a good impression on two people. If you look at the evaluation form there is nothing about ´did the students learn something?´ Part of it is that we´re not told it´s important. We´re evaluated on everything but student learning.

Anne made a similar comment pertaining to survival and the reality of the evaluation.

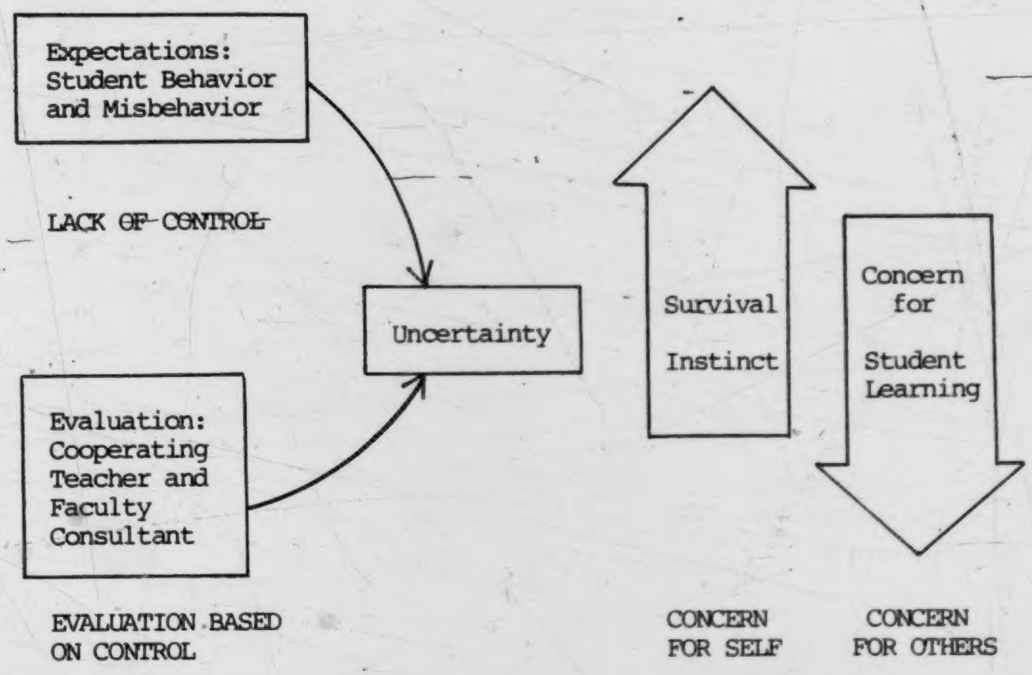
> INTERVIEWER: What were you most concerned about in the senior high student teaching round?
>
> ANNE: Getting a good evaluation. It´s kind of sad, but that´s the truth. Getting through it, that was really it.
>
> INTERVIEWER: You are describing a survival attitude to me. Say more about that.
>
> ANNE: Student teaching, there is so much riding on it. I know that ideally you are there to learn how to teach and to take the experience and learn from it. In fact, there is a lot more to it than that. You are getting an evaluation, you are being graded, tested. This is determining whether or not you will ever be hired. With the way things are right now and teachers being laid off, the competition is incredible. There were 10 applicants for every job in Baffin Island. It´s incredible to think that I can´t even get in at Baffin Island. It´s really tough. I think now more than ever, the student teaching evaluation factor makes it difficult to approach your teaching with a perspective towards learning.

Survival is described as an instinct which evolves from the student teaching experience and overshadows even a concern for student learning. Survival arises from the combined forces of expectations for student behavior and misbehavior (the notion of classroom control) and the pressures which result from evaluations by faculty consultants and cooperating teachers (see Figure 14). Expectations for student behavior may arise from past student teaching experiences, memories of adolescence, or word-of-mouth. Regardless of their origin, unpleasant expectations activate survival instincts which in turn diminish concern for student learning. Even expectations which are pleasant may be disconcerting to the student teacher if such expectations are not realized. If positive expectations are not confirmed, the absence of such may also activate survival instincts with subsequent negative effects on concern for student learning. No student teacher, indeed no human being, can be both primarily concerned with his or her own survival and primarily concerned with his or her students´ learning. Survival (concern for self) usurps concern for others (concern for students´ learning).

Teaching Skills

During the taped interviews with the student teachers, the student teachers were asked to identify the important skills or attributes of a mathematics teacher and preservice mathematics teacher. This list of skills (or teaching qualities) constitutes a description of the type of teacher

Figure 14: The origin of the survival instinct in student teaching and its effect on concern for student learning.



these preservice teachers hold in esteem. This list also identifies the primary concerns and goals of the student teaching practicum as seen by the student teacher. Consider the teaching qualities that are identified by each student teacher:

> TROY: I think patience is the most important attribute. There are a lot of students who don´t understand mathematics. It might be your explanation, or it might be that they weren´t paying attention. Even if you explain something two or three different ways they may still not understand. You have to keep going back, and it´s pretty easy to get frustrated and say "Why don´t you understand it? Look, it´s simple." But remember, it´s easy for you because most math teachers always were good in mathematics even when they were in school. Sometimes it´s hard to understand why they don´t understand it. Besides patience, I think you should know your materials and be able to communicate it. If you have the patience, the knowledge, and can communicate it, then you´ll be a good math teacher.

Troy described three important teaching qualities including patience, mathematical knowledge and communication which are essential for good teaching.

> SUSAN: I think it´s important that a mathematics teacher has a good background knowledge of her subject, but I don´t think that this is the most important. A mathematics teacher has to know what she´s talking about, but she has to be able to put it across to the students so that they can know the material too. I call this communication. Again, this is communication, but a mathematics teacher should have a desire to try and talk at the students´ level so that they can understand and grasp the concepts. I think a mathematics teacher should have a professional attitude because she is a professional.

Susan listed communication, mathematical knowledge, and professional attitudes as essential teaching qualities.

> DARREN: Basically a teacher should have empathy, a knowledge of the subject and then communication skills.

> Communication skills entails being able to get the point across, being able to get their attention, and being able to explain things to them, and being able to get them to understand why things are as they are. Communication implies transfer of knowledge, problem solving in the real world and going beyond absolute memorization activities.

The three qualities which Darren described are empathy, mathematical knowledge and communication.

> SHEILA: Effective communication skills. Being able to put concepts in terms that students can relate to. Being familiar with the language that they use, and being familiar with them. Using them in the examples. Putting it in their language so that they understand it. Being organized. Have a lesson plan. Have your overheads done ahead of time. Go through what you´re going to teach so that you can anticipate what types of questions they might ask and ask them to yourself. And, work out the little errors in your lesson plan. Be enthusiastic. Go in there and say "This is what we´re going to learn". And if you have to pound tables, then pound tables. Try and be as enthusiastic as possible, as math is a subject that many students hate. And, you have to get them motivated one way or another.

The three qualities identified by Sheila include communication skills, enthusiasm, and organization and preparation.

> BERTRAND: I think planning and preparation is important as was driven home yesterday dividing polynomials, not picking a good example and winding up with all kinds of nasty fractions which terrified the students far more than the math skills I was trying to teach. So I think adequate preparation is very important. But I also think being able to cope with that situation and not throw my hands up and say "I can´t do this". Show them a way out, that it can be done with a little patience and a little perseverance so that they won´t despair and realize that there´s nothing magical about mathematics. It´s nothing a little calmness and ability can´t take care of.
>
> INTERVIEWER: Are you referring to Planning?
>
> BERTRAND: It´s partly planning, and partly being confident and able in mathematics as well.

> INTERVIEWER: Are there any other attributes and skills?
>
> BERTRAND: I think obviously interpersonal skills are very important. We can´t let students upset us a great deal, or we end up looking really foolish. And, it´s very hard to recover from looking foolish.
>
> INTERVIEWER: Does that worry you, looking foolish in front of your students?
>
> BERTRAND: Not so much looking foolish, it´s a matter of not being able to regain immediate composure and immediate trust. If I´m some madman who flies off the handle, then they´re going to be worried and take less risks with me and be a lot less comfortable in my classroom. That´s a real worry, because I would certainly hate to make them not want to learn in my classroom anymore.

Bertrand identified the ability to plan for instruction, having knowledge in mathematics, and being able to gain students´ trust as three key teaching attributes.

> ANNE: I think the most important skill is organization. I found this to be a problem. I think that it is really a very important quality that a teacher should have in order to teach well. I also think empathy is important, being able to feel for the students. When you´re up in front of the class, you´re in control, you have power. It´s a very different feeling now that I have toward teaching than when I was a student myself. I can see how it´s very easy to foster the feelings that develop the attitude of being in control and being a disciplinarian and authoritarian. You have to remember that the students in your classroom are people and should be treated that way. There are so many teachers in our system that have been there for so long, and they dehumanize our students. It´s really awful in there, and difficult sometimes to remember that these are people and we should be nice to them. They are here trying to learn, give them a break sometimes.

In her interview, Anne focused on organization and empathy as two essential teaching attributes.

This broad range of quotes describing necessary teaching qualities for successful mathematics instruction may be abbreviated to a list of six characteristics: mathematical knowledge, communication skills, preparation and organization, empathy, enthusiasm, and professionalism. This list of characteristics will be considered individually.

In order to be a good mathematics teacher, one must have a good understanding of relevant mathematics concepts. If teachers possess such an understanding then they will be able to manifest a similar understanding in their students and will appear confident and capable during class instruction. Mathematical knowledge is linked to the phenomenon of communication.

Communication can be considered both a teacher quality and skill. Communication may be considered a teacher quality in that it requires a desire on the part of the teacher to talk in a manner such that the students understand the material. Communication is thus seen as a transfer of knowledge from teacher to student. Communication may also be considered a skill in that transferring knowledge entails getting the students' attention, explaining the content clearly, and ensuring that the students have understood. This process may require patience as some students will not understand as readily as others. The teaching skills necessary for communication can be developed and practised by the student teacher, unlike a desire to communicate. Susan comments "You can learn to communicate better, but you can also be naturally good at communication". To the student teachers who were interviewed, communication has two components: a desire to communicate with students (a teaching quality); and, the ability to obtain student attention, give clear messages, and ensure student comprehension (teaching skills).

Organization and Planning are also key aspects of good teaching. To be considered organized and well-prepared, a teacher must write and use lesson plans, construct overhead transparencies in advance, anticipate student questions and difficulties, eliminate errors from lesson presentations, select effective illustrations and examples, and construct an effective means to keep records. These records include grades, attendance, homework assignments, and any other data which arises from the classroom routine. These teacher characteristics may be considered teaching skills, and they are best learned by modelling. Consider Anne´s comment about organization skills:

> INTERVIEWER: How do we teach student teachers to be organized?
>
> ANNE: This is something that you should do. I think the best way is to show different types of organization. I´ve had three different organization models, my cooperating teachers, but I´ve learned the most from the last because she was the most organized...Except by example, I don´t know how you would show a student teacher the organization of a classroom.

Empathy is a fourth key teaching quality. Empathetic teachers are able to ´feel´ for their students, realize that students are people too, and treat their students well. The result of demonstrated empathy is a mutual respect between the teacher and student. Empathy is seen by these student teachers as having a tempering effect on the control and power which is an inherent aspect of the teaching role. Empathy curbs the tendency for teacher control over students to become excessive thus damaging student interest, motivation, cooperation, respect and learning. The nature and necessity of empathy is described by Anne:

> ANNE: ...Its illogical for you to want them to feel low and to put yourself above them if you want the best for them...I´m not sure empathy will foster good teaching skills and effective teaching, but I think you can´t have one without the other.

Anne makes it clear that there is more to good teaching than empathy, but effective teaching cannot occur without empathy. Empathy is a necessary but not sufficient condition for effective instruction.

A fifth important teaching quality is enthusiasm. To these student teachers, teacher enthusiasm is necessary to motivate students, and is necessary because mathematics is a subject so few students enjoy. Enthusiasm ~~is evidenced~~ through a visual display such as pounding tables when necessary.

The final important teaching quality is the acceptance of a professional attitude. This attitude is necessary as teaching is considered a profession. A teacher who has a professional attitude is one who earnestly desires to be a teacher, dresses properly, uses proper language, and remains calm when tried by students. A professional teacher must not let students upset him or her to the point of showing uncontrolled anger as the teacher then looks foolish to the students and loses the students' trust. Once student trust has been lost, learning is no longer achieved within that class. Trust is manifested by appearing relaxed and confident even when one does not feel relaxed and confident. To appear relaxed and confident sometimes requires acting skills. Anne comments:

> ANNE: ...Something I don't have, but that I think is important, is the ability to be relaxed and feel confident in front of the class. If you are confident, and feel confident, then they will have faith in you as a student teacher. I am awful at it, at least I feel I am. I guess it really comes down to acting, how much of a show can you put on for them. If you've got their faith, their trust, then you can learn how to teach.

It is important to note that many of these attributes are not skills but rather individual personality traits which are not directly teachable by education programs. These ideal personality traits include a desire to engage in communication, patience, empathy, enthusiasm, a desire to be a teacher, and an ability to remain calm in stressful situations to avoid appearing foolish. The necessary teaching skills include an understanding of mathematical concepts, an ability to gain student attention, an ability to make clear descriptions, development and use of lesson plans, preparation of materials, advanced methods of record-keeping, dressing appropriately, and use of acceptable grammar. It is important to note which teaching skills and attributes student teachers consider most important as these skills and attributes may constitute the model which the student teachers will strive to emulate. These skills and attributes are the learnings which student teachers most desire as a consequence of their student teaching experience.

THE INTERACTION/TRANSFER

During the interview with Dr. Jones, it became clear that he had three major goals for the mathematics methods course: (1) to provide the preservice teachers with a conceptualization of the instruction of mathematics; (2) to provide the preservice teachers with a knowledge of, and ability to, employ models in the illustration of mathematical concepts in order to enhance student understanding; and (3) to provide the preservice teachers with an understanding of the mathematics curriculum content with a perspective on appropriate teaching strategies.

Indications of Dr. Jones' intent to provide student teachers with a conceptualization of mathematics instruction can be seen in the following:

> DR. JONES: The things we talked about were just ways of conceptualizing mathematics and the teaching of mathematics...There might be a lack of directness...but one of the things I tried to do in the afternoon sessions was to have them do very practical, working things that they could actually use. But the question is, can they

> conceptualize what mathematics teaching is? I´m not talking about the curriculum. I´m just saying, "Whatever you have to teach, can you conceptualize what the job is?" This is very much an instruction course, not a curriculum course. I make a big point of telling them that because they´re always asking "What should you cover first when teaching this stuff?" And I always say, "Well, any order is possible, but regardless of the order you use, these are the types of things you have to be thinking about."

Later in the same interview, Dr. Jones was asked what the course accomplished:

> INTERVIEWER: In general, what do you think the students got out of this course? What do you think they took away with them?
>
> DR. JONES: How to conceptualize the teaching of mathematics. When they hear anything about the teaching of mathematics, about any kid having trouble, or any teaching assignment that somebody wants to teach a unit on, they will be able to conceptualize the whole operation. What kinds of learning outcomes we should expect, what kinds of things we can engage in, what are the benefits of these types of activities, and so on. I think that´s what I´ve tried to stress in this course.

Dr. Jones´ perception of the conceptualization of teaching mathematics appears to be one that encompasses every step of the learning/teaching process. The ability to conceptualize the entire teaching process was one major goal of the mathematics methods course. This major goal in essence encapsulates the remaining two goals, but each of these goals was also given strong emphasis and as such are described here as other key intentions within the mathematics methods course structure.

The second major goal of the mathematics methods course was to provide student teachers with a knowledge of how models are used in teaching mathematics and the manner in which these models may be used to improve student understanding. To achieve this goal the preservice teachers were asked to provide demonstrations of mathematical concepts both in the morning sessions (EdCI 365) and the afternoon sessions (EdPR 354). Dr. Jones commented on the importance of modelling in mathematics instruction:

> DR. JONES: These models that I´m bringing in are not pie in the sky stuff. How can we use coloured chips to talk about integers? That´s very practical. We just plop them down on the table, and we develop the language for talking about it. All of the models could be used very theoretically and naively, but I warned the students, "If you´re going to use this model, you have to think about the different ways you can use the model. You can´t just bring a full-blown treatment of a model into your classroom and expect either your cooperating teachers or your students to benefit from it or to appreciate it." So, any of the models that we used, that we talked about, are totally legitimate possibilities.

It was Dr. Jones´ intention that the preservice teachers develop an ability to use models in each of the mathematics content areas for the purpose of enhancing understanding. This intention represented the second major goal of the mathematics methods course.

The final major goal of the mathematics methods course was to provide the preservice teachers with an understanding of the mathematics curriculum with respect to teaching procedures and strategies. It was not Dr. Jones´ intent to teach the mathematics itself, but to present the understandings necessary to its instruction. These understandings included strategies for teaching and the development of language systems. Dr. Jones described five strategies for teaching mathematics:

> DR. JONES: ...In this course we have the five strategies - there's the algorithmic strategy which just means use the rules; there's the pattern strategy in which you can show how a concept develops by relating it to a pattern of development; the third strategy is the mathematical model which is a concrete representation of a concept; and the fourth model is mathematical justification where the real basis of knowledge comes from, but we just treat it as another way of talking about mathematics; and then the final one, which is the least well-defined, is the meaning strategy - often our concepts are defined in terms of other concepts, so it's just a matter of giving a new concept meaning through the elaboration of other concepts. Those five strategies, then, we dealt with under each of these topic strands.

These five strategies were used in each mathematics content area, but the strategies were taught to stress the necessity of precise language systems.

> DR. JONES: One of the things that I was quite successful with in this particular offering of the course was in really laying out strategies very clearly. We used them all the time. In almost every case in the junior high school I brought a model in for the whole numbers or rational numbers or decimal numbers or ratios and proportions. One of the conclusions we came up with is that the problem with using a model is that you have to use it enough so that it has some benefit. If you just say, "Well, obviously you can use red and blue chips to talk about integers", you've missed the whole point. You have to develop a language around the model.
>
> One of the things we talked about in using these strategies is that a strategy often means developing a language for talking about something that you can't really talk about. You have to develop a whole set of language around the chips notions. So, that's really the role of the model, but the important part about all of these things, the way I teach it is, that we have all these different ways of talking about mathematics.

The third major goal in the mathematics methods course was to provide the preservice teachers with an understanding of the junior high and senior high mathematics curriculum through introducing five teaching strategies.

The goals of the course as they were defined by Dr. Jones seemed to be quite different from that which the students actually learned. Dr. Jones´ goals were somewhat general in nature and he intended for them to transfer to the student teachers´ classroom situations. The course materials that the student teachers used, or at least reported that they used, were very specific. The student teachers reported having used the do-now exercise (a component of the lesson plan format Dr. Jones proposed), some specific teaching strategies and example problems, reasons for studying mathematics, techniques in blackboard use, and questioning methods.

Several student teachers reported having used the do-now exercise.

> SUSAN: ...Another thing that helped me was the discussion of lesson plans. We were given a general form of a lesson plan that included a do-now exercise. This exercise enabled me to review from the day before.

> DARREN: The only thing that I´ve used out of that course is the do-now exercise.

Anne reported having tried the do-now exercise, but it did not work well for her.

> ANNE: The lesson plan format that Dr. Jones suggested is one that I tried and found not entirely useful. I found the do-now exercise to be a waste of time and so I dropped it after trying it.

Three of the student teachers who were interviewed specifically mentioned experimenting with the do-now exercise (with various degrees of success).

One student teacher reported having used the general teaching strategies which were discussed in the mathematics methods course.

> SUSAN: The section on different teaching strategies helped me. It made me more aware of how as teachers we must be aware of different ways of teaching concepts. For example, in the last two days of my student teaching we were working on percent problems...The first day I used one strategy to teach them and no one understood. So I had to go home and think of a different strategy for teaching it. In this way what Dr. Jones said helped because I could fall back on his other theoretical possibilities and find different ways to teach it.

Other student teachers reported specific examples or illustrations demonstrated in the mathematics methods course which they employed in their student teaching.

> ANNE: When teaching factoring, illustrating a polynomial as the area of a square with the sides of the square being the factors of the polynomial was one teaching strategy that I used. I tried it and I think it would have worked with a little more application. As it was, we were really rushed so I never really got to work with it. I also tried some general teaching strategies.

> SHEILA: [I tried] some of the examples that we talked about. For example, I´m teaching logarithms right now and some of the practical examples that we had of logarithms I used in the classroom.

> BERTRAND: ...I was really skeptical about teaching the positive and negative integers using the mailman analogy where he brings bills and cheques, or using coloured chips. I really didn´t think it would be very effective. I had one class that had difficulties with adding and subtracting integers and I tried the mailman analogy, and it worked wonders. It was absolutely amazing, the class picked up on it very quickly. I was buoyed by that success and tried it again the next period to dismal failure.

The use of general teaching strategies and specific analogies and examples (as discussed in the mathematics methods course) were transferred to, and used in, the student teaching placement.

Other concepts were not as widely discussed in the mathematics methods course, but these concepts too had some transfer to the teaching practicum. Sheila and Bertrand both reported the usefulness of having a repertoire of reasons for studying mathematics.

> SHEILA: I gave the reasons for studying geometry to my students. That was one thing that Dr. Jones did discuss, why you are learning something. I thought that this was really good and it's important to give that to the students because on those days when they get really frustrated and ask "Why are we here?" you can always refer back to those.
>
> BERTRAND: One thing that Dr. Jones hinted at that I...enjoyed...was "Why are we teaching this anyway?" I think this is one of the core philosophical problems that we should wrestle with a lot more.

Sheila reported the helpfulness of techniques for blackboard use while Anne mentioned the usefulness of the star questioning technique.

> SHEILA: In the junior high I tried his little trick of 'don't erase the blackboard'...It works really well, because I can always just refer back to it.
>
> ANNE: At one point we mentioned the star method of questioning and when you question students, what do you do. I found this sort of thing very helpful.

There were several concepts and skills which transferred (for most students) from the mathematics methods course to the student teaching classroom. However, the concepts which transferred tended to be very specific examples, skills and techniques, not the general teaching principles desired by Dr. Jones. Of course, there is no evidence to indicate whether these specific skills arise as a function of the unknowing adoption of a certain conceptualization of teaching, or even if, in fact, these skills and techniques existed prior to, or independent of, the methods course. It can be concluded at least, that student teachers do not report having adopted many (if any) of the general teaching philosophies espoused in the mathematics methods course. In fact, some student teachers claimed that very few of the concepts presented by Dr. Jones transferred to the classroom.

> TROY: I´m not really sure what I got out of the course. I think that maybe there was an effort to cover too much, or maybe there was not enough detail. Mostly we talked about broad goals. I´m really not sure if I got anything out of it. I´m not sure that this one course is going to make me a better teacher...I think the benefits of this course will show later on if I´m lucky enough to get a job. I´ll think back and remember some content and different approaches. Three weeks is not a long time to learn so much material.

> SUSAN: I realize that the theory behind the practice is important, but we don´t always see the connection. I wish he could have made the connections more explicit.

> DARREN: There weren´t many helpful specifics. Maybe I don´t remember them because they were small points, or maybe I just didn´t understand them, or maybe I ignored them, but I didn´t feel that there were a lot of topics that stood out in the course.

Dr. Jones´ intention was to assist his students in developing a conceptualization of mathematics teaching, but the students wanted specific teaching tips and hints for successful instruction. These tips and hints are the only concepts that the student teachers claimed they had adopted in their practicums. There exists a disparity between Dr. Jones´ goals and the student teachers´ expectations and learnings. This disparity results in minimal transfer of the mathematics methods course content to the teaching practicum.

CHAPTER SIX

Findings and Implications

The purpose of this chapter is to list the conclusions which result from the analysis of the data and to list implications for teacher training which are a function of these conclusions.

The conclusions which are made pertain to the specific group of student teachers who participated in this study. The following stance is accepted:

> The sampling problem is not really a problem at all; one instance is likely to be as typical and as atypical as another. The problem of generalising ceases to become a problem for the author. It is the reader who has to ask, what is there in this study that I can apply to my own situation, and what clearly does not apply? (Walker, 1980, p 34).

The degree to which the students in this study are similar to the students in any other mathematics methods course is a decision that can be made only by the instructor of that other course. To the extent that these students are similar to other students, the results, conclusions and implications do generalize.

[1] Successful teaching experiences in the junior high are primarily a result of being able to give clear examples, being able to control discipline problems, and being accepted as a teacher by the students. Nonsuccessful teaching

experiences are a result of not being able to handle discipline problems, and not having adequate lesson plans or other textual materials. Successful teaching instances in the senior high arise from being able to motivate students, being accepted as a teacher, and being able to provide clear examples and illustrations. Nonsuccessful teaching instances arise from not being able to give clear examples, being poorly prepared and not being able to control student behavior.

[2] When student teachers encounter nonsuccessful teaching instances, they have a greater tendency to question their competency. Student teachers place a greater emphasis on stage one concerns when encountering nonsuccessful teaching instances.

IMPLICATIONS: Regardless of the age of the students being taught, student teachers are very concerned about being able to discipline students, being able to plan good lessons, and being able to find and use good examples and illustrations. It is not clear that all these skills are necessarily the skills which are meant to be taught in the mathematics methods course, but certainly the skills of lesson planning in mathematics instruction and providing good examples could become a focus of a such a course. It is recommended that before the student teachers go out into their junior high student teaching round, that they be given a session on behavior management. Because student teachers are so concerned about being able to motivate high school students, the student teachers should also be given a session on motivation techniques (such as positive reinforcement and the use of reward systems) prior to the second practicum. To alleviate the difficulty student teachers express in finding and using good classroom examples, a sourcebook of teaching ideas should be developed for each content strand in the secondary mathematics curriculum. The student teachers could work as a group to collect such materials. This project may help to alleviate difficulties in lesson planning and presentation.

[3] Female student teachers tend to encounter their greatest teaching difficulties in planning and preparing materials, being accepted by their students as a teacher, and being able to deal with discipline problems. Males tend to have their greatest problems in presenting clear examples and in disciplining students.

[4] A greater percentage of females experience stage two success than do males, but a greater percentage of females experience stage one nonsuccess than do males.

[5] Females appear more concerned with the form of a lesson, while males are more concerned with the content of the lesson.

[6] Males tend to be slightly more sensitive to student learning than are females, but neither males nor females

express a large concern for student learning.

IMPLICATIONS: Females may sense a greater difficulty becoming accepted as a teacher in their teaching placements. Evaluators of student teachers should be aware of this phenomenon and should assist these student teachers wherever possible in setting expectations and following through with consequences in order to expedite role development. Discipline is a major problem for both males and females and thus student teachers should be made aware of discipline strategies and alternatives within each student teaching placement. The instructor of the mathematics methods course may wish to pursue this topic within the structure of the course. Males may need extra time and practice in preparing and presenting examples and illustrations of given mathematics concepts, while females should be given an opportunity to explore several alternative organizational schemes. Lesson planning should be emphasized both in terms of form and content. Finally, an over-emphasis on stage two concerns during the methods course may result in student teachers having a low regard for student learning. Classroom considerations are important only in that they lead to student learning. Specific skills and strategies should be taught from the perspective that the skills lead to enhanced student learning. Student teachers should be constantly questioned on why they employ the methods that they do, and how effective their chosen strategies are in terms of student achievement. In this manner, stage two concerns are taught with an expressed purpose: to pull student teachers toward the third developmental stage (as defined by Campbell and Wheatley, 1983).

[7] There are no major differences in the reported instances of successful and nonsuccessful teaching between first degree and after degree student teachers, although first degree students tend to be slightly less concerned with being able to motivate students than are after degree students.

[8] Because first degree preservice teachers have a lesser understanding of the mathematics discipline, these student teachers may have a greater difficulty in finding good examples and illustrations. The lack of good examples and illustrations may lead to greater difficulty in lesson planning.

[9] After degree student teachers seem better able to cope with the rigors of the mathematics classroom as they do not retreat to stage one concerns (to as large an extent) when encountering nonsuccessful teaching instances. There is nothing to show that after degree students make better or worse student teachers, but after degree students appear to be less concerned with student learning than are their first degree counterparts.

IMPLICATIONS: First degree student teachers should be queried on how well motivated their students are, and encouraged to research theories and experiment with different alternatives in motivating their students. All student teachers may need a resource of example problems and illustrations, but this resource will be most beneficial to first degree students. Finally, it cannot be concluded on the basis of this study alone, that preservice teachers should have a previous undergraduate degree in mathematics, or that this previous degree will assist them in becoming better mathematics teachers.

[10] Student teachers become less concerned with classroom environment and work accomplishment over time, but more concerned with discipline and student motivation.

[11] Student teachers typically do not progress to stage three concerns for student learning during their student teaching experience. The development of stage three concerns for learning needs to be encouraged.

IMPLICATIONS: Evaluations of student teaching experiences should be child-centered. To encourage a consistent concern on the part of student teachers for the entire learning environment, formative and summative evaluations should be based on the development of productive learning environments, not on the demonstration of individual skills and teaching techniques. To perform such an evaluation requires the asking of questions such as "what effect have your actions had on the quantity and quality of your students' learning?", and "what evidence do you have to prove that your students have learned anything from your instruction?".

[12] Some student teachers may accept blame for nonsuccessful teaching instances and share credit with their students for successful teaching instances.

IMPLICATIONS: The allocation of blame and credit does nothing to develop a productive learning environment. Instead, the notion of accountability for behavior and accountability to classroom roles should be encouraged. The allocation of blame and credit shows a lack of conceptualization of what teaching mathematics really means, and indeed teaching in general. As student teachers come to develop firm conceptualizations of teaching and learning roles and accountability for such roles, they may need a vent to discuss frustrations and successes. This vent could be provided by the methods course instructor by holding debriefing sessions during and after the conclusion of each student teaching round. Student teachers should be asked to identify what their function as a teacher in a mathematics classroom entails.

[13] Rumors about student teaching experiences cause excessive stress and emphasis on survival. Student teachers

tend to expect that they will encounter many difficult discipline problems in the junior high and will have difficulty motivating senior high students. Student teachers also expect that senior high students will take more responsibility for their own learning.

[14] The sensations of uncertainty and stress are a reality of the practicums under the present system.

IMPLICATIONS: To counteract erroneous expectations for the teaching practicum, student teachers should be given an extensive opportunity to carefully view their classes in operation before they are required to undertake any teaching responsibilities. While observing, the student teachers should be asked to look for evidence for their expectations. In the case of confirmed negative expectations, the student teachers should be encouraged to look for possible solutions before the practicum begins. This is one way in which some stress may be alleviated. To further alleviate stress, the teacher educator must be continually looking for non-threatening means to complete evaluations. There are many institutional and political reasons for the completion of student teacher evaluations, but these evaluations cause stress. It is necessary to look for alternative evaluation means to alleviate stress and allow student teachers to concentrate on their students´ learning.

[15] Student teachers recognize the following as key

teaching attributes: mathematics knowledge, communication skills, preparation and organization, empathy, enthusiasm, and professionalism.

IMPLICATIONS: The teacher educator should recognize that the above list of teaching attributes represents the kinds of skills and techniques that the student teachers see as important and may represent the template by which the material in the mathematics methods course is either assimilated or rejected. This list may serve as an initial list of criterion for evaluation purposes. Once initial evaluations are undertaken, the evaluator may extend this list to encompass other skills or attributes deemed necessary. This list of attributes may also serve as the starting point for the formulation of a curriculum which the student teachers will see as relevant and helpful, especially pertinent to the teaching practicum.

[16] The philosophical and theoretical goals as they have been identified by the methods course instructor have not been achieved by the student teachers. The student teachers are looking for solutions to very practical classroom situations and teaching problems.

IMPLICATIONS: Explicit links should be drawn between the mathematics methods course and the student teaching round. These links may be achieved by addressing those issues which student teachers see as most crucial to teaching success and nonsuccess. Theoretical and philosophical concepts should be discussed only after the completion of the student teaching experience. If the concepts are taught at this time, the student teachers have a reference base with which to assimilate this knowledge, and have the stressful experience of student teaching completed. Teaching the theoretical concepts after the practicum does not permit the student teachers to experiment with the philosophical and theoretical concepts in the practicum, but the student teachers tend not to do so anyway. The student teachers could be recalled to campus for a period after the student teaching rounds and during this time the philosophical and theoretical concepts could be addressed.

SUMMARY STATEMENT

The purpose of this study was to carefully reconsider the nature of the student teaching experience within the context of the mathematics methods course. Much has been learned about the developmental stages of student teachers, their incidents of successful and nonsuccessful teaching, and the fact that student learning is overshadowed by the occurrence of stress and survival instincts. These findings have implications for the mathematics methods course instructor.

At first it seems shocking that student teachers are not concerned with their students' learning, but this fact should not be even slightly surprising. Student teachers are taught techniques and strategies with little emphasis on learning, thus this is what will be evidenced in the teaching practicum. The teacher educator must realize that the production of teachers concerned for their students' learning is the ultimate goal, and to achieve this goal requires the development of specific skills, techniques, and instructional methods. The teacher educator must accept responsibility for the progression through all three stages of development in order to achieve the ultimate goal, and this will require a reconsideration of the concepts taught in the methods course, and the means by which the student teaching round is evaluated.

If there exists one central theme which pervades this entire study, it is that teacher educators must be continually aware of the complex issues which surround the training of mathematics teachers and the student teaching experience. If this study has provoked the reader to reconsider his or her methods for teacher education, then it has achieved its highest ambition.

CHAPTER SEVEN

Reflections

The purpose of this chapter is to discuss some findings and theories which have developed during the course of this study but cannot be fully substantiated by the body of collected data. There are three topics which this chapter covers: the paradoxic world of the student teacher, the role of learning in student teaching, and the respective influence of the professor and cooperating teacher over student teachers.

THE PARADOXICAL WORLD OF THE STUDENT TEACHER

A paradox is any phenomenon which appears to hold two opposing qualities simultaneously. For example, "The man stood in the blazing sun but his heart was gripped by ice". There are many paradoxes in the student teaching experience.

Is student teaching an opportunity for student teachers to experiment with their own teaching styles or is it a time to copy and learn from the cooperating teacher? The student teacher is responsible for carrying on where the cooperating teacher left off and for maintaining a sense of continuity, but the student teacher is also supposed to be experimenting with his or her own techniques. Obviously, there must be a balance between the two extremes. The student teachers seem unable to find such a balance. For Anne, it was not a very good experience.

> ANNE: I felt very constrained and pressured to adopt his teaching style. I don´t know whether it was him or me or both. Things didn´t go well and the whole round was not happy or comfortable at all.

Troy and Sheila both sensed a desire to develop their individuality, but both succumbed to the pressures of the classroom and copied their cooperating teachers.

> TROY: I think it´s the classroom climate that is created by the teacher that affects the way that you teach. You adapt to what is going on. If all of my students had been angels the whole time I was there, I probably would not have had to yell. But if the teacher yells, and I come in and don´t yell, and it works for me, then fine. But what happened was that I tried a different approach than the teacher and it didn´t work. So I had to adapt to the climate of the classroom to survive.

> SHEILA: That´s one of the things that I found hard about student teaching is that you can´t establish the rules in a month like you would want to. As much as you would like to develop your own teaching style, you can´t in some ways. You´re so limited by the rules that that teacher set out in the beginning.

The pressures of the teaching practicum, whether they are imposed by the cooperating teacher, the students, or the restraints of time cause students to simply adopt the cooperating teacher´s style. Is this desirable? Is this the purpose of the student teaching experience? A paradox exists: Student teachers must simultaneously develop their own style and mimic that of their cooperating teacher.

Are student teachers placed in schools to develop teaching skills or to demonstrate teaching skills? The brevity of the practicum implies that the latter is true while the common understanding is that the former is true. In some way, student teachers are expected to be competent teachers from the outset, but this expectation is not realistic:

> TROY: As a student teacher I think you should aim for some of the same qualities as an experienced teacher, however you must realize that you´re not in the same league. You are working towards it and eventually you´d like to have the same skills. You do need a lot of patience. Your communication skills are probably poorer, and your knowledge is weaker.

> SHEILA: You do not have the experience of a real teacher, you are not a real teacher.

Being a teacher demands the faith, trust and respect of the students.

> ANNE: I think the kids have to develop trust and respect you as a student teacher, and that´s the biggest stumbling block. You are only there for four weeks. They know you´re only a student teacher, and they know you´re new at this and they are going to want to test you. They don´t want to respect your authority. You enter into the classroom with a low level in their opinion...So you worry about how they will respect you and how you will make them respect you. Because of this, I end up feeling that I am dehumanizing the student and taking advantage of my position over them.

Being accepted as a teacher by the students is a difficult prospect for any student teacher. This difficulty is magnified by the reality that sometimes students do not want to accept the student teacher as a teacher. Becoming a teacher is a process. Being a teacher requires skills which the student teachers do not yet have. It is unreasonable to expect student teachers to perform as competent teachers during the time intended for them to develop the necessary skills. Student teaching must either be a chance to demonstrate acquired skills or a chance to learn these skills. It cannot be both. The coexistence of these extremes constitutes a paradox.

Student teachers feel disoriented and insecure in other teachers´ classrooms.

> INTERVIEWER: When you were student teaching in a Senior High classroom, what things did you worry about the most? Why?
>
> BERTRAND: Being an intruder in someone else´s environment.
>
> INTERVIEWER: Whose environment?
>
> BERTRAND: The teacher´s and the students´. I´m new there. I don´t own anything except my briefcase and my pen. They´re all comfortable; they have their places. The teacher has his desk with his stuff on it and his stuff in it, his books along the walls. So even though you tend to settle in it a little bit more, it´s still someone else´s room that I´m in. You feel like a substitute teacher actually...I was afraid of student aloofness. I was afraid that there would be social pressures and peer pressures and it would be very difficult to fit in and talk to them without really threatening their established environment.

As a visitor, student teachers feel awkward and approach their experience tentatively, but this is not what the nature of the practicum demands. To be successful, the student teacher needs to assume complete control of the classroom situation.

> INTERVIEWER: When you were student teaching in the Junior High classroom, what things did you worry about the most? Why?
>
> DARREN: Probably control. This is a big issue, and

> until you have control there isn't much else that you can do as a teacher. You can come into class with a good lesson plan, all sorts of good ideas, but if the students were not really listening it was just a wasted period. Until you have the control, the pace, the amount of material, and your knowledge don't really matter.

The need to assume control and the feeling of insecurity demand very different behaviors from the student teacher. As the need to assume control and the feeling of insecurity occur concurrently, their coexistence constitutes a third paradox.

A fourth paradox arises from the relationship between the cooperating teacher and the student teacher. The student teacher is supposed to work with the cooperating teacher and learn from that interaction. But to the student teacher, the cooperating teacher is seen as an adversary. This sense of competition results from comparisons made by the students between the student teacher and cooperating teacher.

> INTERVIEWER: Do you see yourself as competing with the cooperating teacher?
>
> BERTRAND: I try not to, but I think there is some amount of it going on. There will be some students that will be very sad to see me go and some that will be very thankful to see me go depending on their success in the last four weeks...So I think it's inevitable, there is some in the students' minds. Between my cooperating teacher and myself, we don't feel any of that...We're not competing, we're just very different personalities, and quite happily that way.

Bertrand states that the sense of competition arises from comparisons made by students and not from the student teacher or the cooperating teacher. Sheila describes a more intense sense of competition:

SHEILA: My cooperating teacher has 23 years of experience and that makes it hard. The students are used to him never making mistakes and when I go through the material, I make some mistakes, and they lose confidence in me...

INTERVIEWER: I´m curious about your cooperating teacher. You mention him almost as an adversary. Do you feel a sense of competition with him in the classroom?

SHEILA: Yes. He´s a very competitive person in his attitude toward teaching. He´s a very outgoing person and within the class he´s mentioned that "Yeah, she´s here. She´ll take over for a little while and she´ll try her best, but she´s still not me"...

INTERVIEWER: You say that you sense this competition from him, but do the students also compare you against him?

SHEILA: Yes, but I´m that type of a person. I feel it, "Well, she can´t teach as well as Mr. Smith can. I wish we could have Mr. Smith back". Some days, like today, when lessons don´t go very well, that´s what I think the students are thinking. And I hate to think that way. It just motivates me more. I want to go in there the next day and prove to them that they´re wrong.

Competition may or may not arise from the cooperating teacher, but it is consistently caused by the students. Can the cooperating teacher and student teacher be both adversaries and allies toward some productive end? The nature of the relationship between the cooperating teacher and student teacher constitutes a fourth paradox.

The existence of these four paradoxes illustrates that the student teaching experience is a very complex phenomenon. That which teacher educators expect student teachers to achieve during the practicum may be very different from that which is actually achieved. The practicum is not necessarily as it appears. This paradoxical nature of the teaching practicum may contribute extensively to the existence of a survival attitude. By better understanding the nature of the practicum, it may be possible to alleviate the occurrence of these attitudes.

THE ROLE OF LEARNING

As was pointed out in the review of the literature in Chapter Two, student teachers are not primarily concerned with student learning during their practicums. Placek (1983) reported that student teachers were concerned primarily with keeping students busy, happy and good. Placek and Dodds (1986) concluded that the evaluation of the practicum keeps student teachers from focusing on student learning. In one of Fuller´s studies (1969), he found that student teachers were primarily concerned with self-adequacy and student control, not on student learning. Campbell and Wheatley (1983), after describing the three development stages (stage three being concern for student learning), commented "Unfortunately, many students do not seem to reach the third stage during student teaching" (p 60). All this evidence seems to summarize to one sobering thought:

> ...Our goals as teacher educators to produce teachers who are concerned not only with student enjoyment, but also student learning, may be fantasy. Even while students are within our grasp at the university, they may be slipping into an unconscious acceptance of the status quo in many school programs (Placek, 1983, p 55).

Student teachers, under the present education program, are not coming to view student learning as the primary purpose of teaching.

In reconsidering the data tables in Chapter Four, it is obvious that of the three development stages in almost every data classification (except in nonsuccessful critical incidents reported by males), stage three percentages are the lowest. The findings in this study therefore corroborate the findings of Placek (1983), Placek and Dodds (1986), Fuller (1969), and Campbell and Wheatley (1983). However, in this present study it is noted that student teachers, if not primarily concerned with student learning, are at least aware of it. Consider these comments made by the student teachers:

> TROY: The best feeling I got from the whole experience included knowing that I wanted to be a teacher...I came out wanting to be a teacher because I felt I had accomplished something...Perhaps it´s more that the students accomplished something, they learned something. But then as a teacher it´s your job to have your students learn.

> ANNE: ...Being able to go into the classroom and approach teaching not through control of the students but through helping the students learn something is very different than the common concept of teaching, especially math teaching...I think it´s really tough in the math class to encourage feelings of success in your students.

All six of the interviewed student teachers made some comment that at least referred to student learning. In fact, of the 20 students who participated in the completion of the critical incidence forms, nine students provided at least one stage three critical incident; 45.0% of the student teachers reported at least one incident illustrating concern for student learning. However, these nine student teachers only reported 18 such instances of the possible 143 (12.6%). This data shows that student teachers are at least aware of, if not primarily concerned with, student learning.

If it is accepted that the informants of this study have some awareness of student learning, then the following conclusions can be made. The fact that student teachers do not commonly report incidents of student learning is: not necessarily a product of their lack of concern for it; not a product of the age group taught (Junior High or Senior High); not a function of the student teacher's sex; not a function of the number or type of previous degrees held; and not a function of the length of time spent student teaching. The fact that Placek and Dodds (1986) came to the same conclusion when working with physical education majors implies that lack of concern for student learning is also not a product of the academic discipline; it is a product of the nature of the practicum.

Student teachers are aware of student learning, and may recognize student learning as the goal of the mathematics teacher, but the nature of the practicum ensures that student learning does not take precedence.

RELATIVE INFLUENCE OF THE COOPERATING TEACHER AND METHODS COURSE INSTRUCTOR

A phenomenon which arises from studying the transcribed taped interviews, is that cooperating teachers have a very strong influence over their student teachers, significantly more so than do university instructors. Consider the interview with Darren:

> INTERVIEWER: When you are communicating with your students, as you have described communication, what are you trying to get across to the students?
>
> DARREN: I´m trying to get across a bit of the content, but more an understanding of the subject. You´re trying to bring them into your experience, your world. I see myself as being their link to the adult world. The other adults they deal with include their parents, which they are tied to and which they may view as either right or wrong. But you, as a teacher, can give them insights into things that their parents don´t and insights into things that their parents do, but in different ways.

A later excerpt from the same interview:

> INTERVIEWER: describe some of the emotions you felt while student teaching.
>
> DARREN: One day, when the principal was in class watching, the students were quite out of control. It was a grade seven social class, and he had mentioned before that I should get more of myself into the class and tie me and the adult world to the students.

It becomes obvious from this interview that what the school principal had to say had such an impact on Darren that it was incorporated into his philosophy of teaching. Consider a comment made by Troy:

> INTERVIEWER: Are you saying that if you go into a classroom as a student teacher you have to do what the teacher before you did?

> TROY: Not necessarily in all areas, but in discipline procedures I think you should stick with what your teacher does. You don't have to follow exactly. For example, if he uses the overhead projector a lot, you could still use the blackboard. Students get used to a teacher's style after awhile, and if you take on the style of the teacher there will be fewer problems with the transition from one teacher to the next. I've heard it said that the cooperating teachers you have during your student teaching experience determines what kind of teacher you will be. I can see that as true.

This phenomenon could be held in contrast to the responses student teachers gave to the following questions: During your first three weeks with your instructor, what things did he spend the most time discussing? What things do you wish had been given more (or less) emphasis? Quoting again from Troy,

> TROY: I'm not really sure what I got out of the course. I think that maybe there was an effort to cover too much, or maybe there was not enough detail...I'm really not sure if I got anything out of it. I'm not sure that this one course is going to make me a better teacher.

When pressed further, student teachers claim that they use (in their practicums) little or nothing of what is taught in their methods course, and in some cases honestly cannot remember what has even been taught.

What is the cause of such a large difference in influence? There are three answers to this question: modelling, proximity, and practicality.

The nature of the practicum is such that student teachers are intended to watch and learn from their cooperating teachers.

> INTERVIEWER: In order to have a successful experience

> teaching Junior High mathematics, what advice would you give another student teacher?
>
> TROY: I would advise them to go in there with the attitude to learn. Don´t go in there and say "I know it all and this is the way I´m going to teach". Be as flexible as you can be. Ask a lot of questions of your cooperating teacher, these people have been in the field a long time. Ask how they would deal with a certain problem and ask if you´re doing a good job.

The cooperating teacher has a profound influence on the student teacher because of modelling, but also because of proximity. At the time when student teachers are struggling with various problems, the cooperating teacher is there to give advice.

> SUSAN: ...Sometimes I felt really frustrated with some of my classes. I felt that they were controlling the class and treating it like a social hour not math period. I didn´t know what to do to bring them back to math sometimes. When I was frustrated like this I would talk to my cooperating teacher and ask him what he would do when this happens.

> BERTRAND: [My cooperating teacher] has been the sort that sits back and lets me go. He is often in the classroom...He´s encouraged me to do things as I see fit and cautioned me when I was treading in dangerous waters like becoming too friendly with the Grade 10 class and them not responding as well as they might.

The cooperating teacher, unlike the methods course instructor, is always nearby to give advice and assistance when needed.

The third cause of the dramatic difference in influence over the student teacher by the cooperating teacher and the methods course instructor, is that the cooperating teacher is seen as a source of practical information.

> BERTRAND: ...The students weren´t prepared for such a

> non-concrete approach as that which Dr. Jones provided. We came in seeking answers and came out with nothing but questions...In comparison, the cooperating teacher has a method of doing things. You ask him questions about how he does this or that, and you get solid, hard answers...This is much more reinforcing than hearing "Well, that's a very difficult question and there are many ways to go and I'm not sure which one is best". This is perhaps the more academically sound answer, but certainly less satisfying.

Dr. Jones was aware of the difference in influence and tried to accommodate for that difference.

> DR. JONES: What I say is, "You have to teach the way your cooperating teacher is going to teach, you have to admit that. But, even if you take his lesson plans, you can allude to an application, you can show a model, you can use a pattern, you can explain it involving these patterns. So you have no chance of modifying the overall approach, but all of these things can inform your teaching so that you will be an intelligent teacher." I say that a lot. Forget about really changing anything that your cooperating teacher is doing, but anything we talk about here can be used to make your teaching better, but minimally. So, I see a definite conflict, and I try to admit that conflict and admit that the cooperating teachers have a valuable perspective. The thing I want to avoid when they get confronted by the cooperating teacher is that my perspective doesn't get completely blown away. So I teach it as this: "You can use this in these different ways. It can influence your teaching." That's how I try to prevent it from losing all credibility. Before, I used to say, "This is how I think it should be taught. You go out there and do the same." Then they just say, "What Jones said is irrelevant." But now they can say, "What would Jones do faced with this same situation?"

The preservice teachers seem to sense a real distinction between that which is learned on campus and that which is learned in the practicum. Consider the comment made by Troy:

> TROY: [The purpose of the practicum is] to get experience and see how you like teaching. It is a time to practice some of the theory you have learned. They can give you a lot of theory, but it is different when you're standing in front of the class. You can sit and

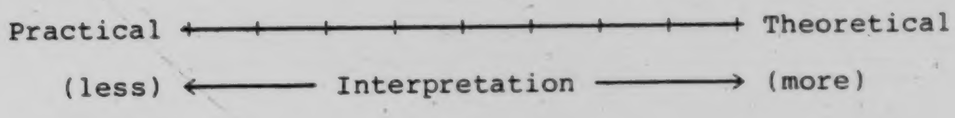
> talk about how things should be and how they should be done in a perfect classroom and this is what happens, but some of the theory you can just throw out the door. If you learn something from theory, you just learn it. If you learn through experience, it sticks with you a lot better.

What is the difference then between practical and theoretical?

> INTERVIEWER: How can you tell when what you are being told is practical or theoretical?
>
> ANNE: You take all these ideas and methods out and try them. When you decide that a certain idea is not one that you would use in your teaching simply because you do not have time to touch upon it, then you know that it was theory...
>
> INTERVIEWER: Is practicality the same thing as usability?
>
> ANNE: No. You can have a practical suggestion that is useless. You can have a practical suggestion that will work for only one type of person. A suggestion one of my cooperating teachers made to me was to yell at the students. This is a practical suggestion, but it wasn´t useful to me at all. I don´t like doing it...and it would bother me a lot. So it was a practical suggestion but it was useless.
>
> INTERVIEWER: Then how do we know if something is practical or theoretical?
>
> ANNE: I don´t know.

It would appear that the usability of a concept is not sufficient to determine its practicality. There are two criteria which are employed to distinguish between the practical and theoretical. First, to be practical, a concept must be usable and desirable. If a concept is not desirable, it will not be used and therefore cannot be practical. Second, a concept tends to be either practical or theoretical depending on the degree of interpretation which must be employed for its use. A concept which transfers directly into the classroom with little or no interpretation is considered practical. The greater the degree of interpretation which is required for a concept's use, the less practical and more theoretical it becomes (see Figure 15).

Figure 15: Discerning between theoretical and practical.



The information which Dr. Jones provided to his students required more interpretation than that which was given by the cooperating teachers, and thus Dr. Jones was seen as a source of theory while the cooperating teachers were seen as sources of practical tips, hints and suggestions. During a time when survival instincts have risen, such as the practicum, it is to be expected that the input of the cooperating teachers would be more valuable as it is more practical.

> DR. JONES: ...Because the motivation is so high they just want practical things. I like the example: If a bull is chasing you, it increases your capacity to jump the fence, but it detracts from your capability to pick a lock on the fence.

The difference in influence which Dr. Jones and the cooperating teachers had over the student teachers may be accounted for by modelling, proximity and practicality.

The topics which are discussed in this chapter cannot be fully substantiated by the data collected during the course of this study. To make definitive statements would require much further research. It is, however, valuable to understand better the complex nature of the teaching practicum and its impact on stress and survival. It is valuable to know how student teachers perceive the interrelation of teaching mathematics and student learning. It is valuable to know to what extent and in what ways the cooperating teachers and methods course instructor influence preservice teachers. By understanding better each of these issues we can improve preservice education by making changes, where necessary, to provide the best experiences and produce the most skilled and confident mathematics teachers.

POSSIBLE FURTHER RESEARCH QUESTIONS

[1] Considering that student teachers do not develop to stage three concern for student learning, what is the role of the university in the education of preservice teachers?

[2] At what stage in an individual´s career does a concern for learning manifest itself? What are the conditions

whereby this concern is manifested? Is it possible to have individuals reach this stage sooner?

[3] How do we characterize a student teacher (or any teacher) that has reached stage three? What critical incidents would such a teacher report (i.e., what is the scope of the third stage)?

[4] What role does the teaching methods course instructor play in the development of the preservice teacher? Should this role be enhanced and in what way? How would we evaluate the effect that this has on student teachers?

[5] What is the nature of the influence of the cooperating teachers on student teachers?

[6] How can we account for the paradoxes of the student teaching practicum? What effect do these paradoxes have on the survival instinct of the student teachers? What other paradoxes exist?

[7] How accurately can students identify their own developmental stage? The answer to this question has implications for the emphasis that student teachers think they put on learning versus the reality.

[8] What effect does a grading system have on the student teachers and the survival mechanism?

[9] How realistic are the self-evaluations of teachers and student teachers of themselves in terms of teaching effectiveness?

[10] Under what conditions is the content knowledge of mathematics made most understandable?

[11] Do school system evaluations have the same effect on the survival instinct of experienced teachers as do the practicum evaluations of student teachers?

BIBLIOGRAPHY

Adelman, C., Jenkins, D., & Kemmis, S. (1980). Rethinking case study: notes from the second Cambridge conference. In Helen Simons (Ed.), Towards a Science of the Singular, Occassional Publication No. 10 (pp. 47-61). University of East Anglia: Centre for Applied Research in Education.

Aviv, C. A., & Cooney, T. J. (1979). Results of a questionnaire on secondary mathematics teacher-education programs. Mathematics Teacher, 72, 530-536.

Balka, D. S. (1986). Characteristics of outstanding secondary school mathematics teachers. School Science and Mathematics, 86, 322-330.

Begle, E. G. (1979). Critical variables in mathematics education: findings from a survey of the empirical literature. Washington: Mathematics Association of America.

Berliner, D. C. (1984). Making the right changes in preservice teacher education. Phi Delta Kappan, 66, 94-96.

Burger, W. F., Jenkins, L., Moore, M. L., Musser, G. L., & Smith, K. C. (1983). Teacher preparation--a coordinated approach. Arithmetic Teacher, 30(8), 21-22.

Campbell, P. F. & Wheatley, G. H. (1983). A model for helping student teachers. Mathematics Teacher, 76, 60-63.

Carpenter, T. P., Fennema, E. & Peterson, P. L. (1986). Cognitively guided instruction: an alternative paradigm for research on teaching. In G. Lappan & R. Even (Eds.). Proceedings of the Eighth Annual Meeting for the Psychology of Mathematics Education (pp. 225-230). East Lansing, Michigan.

Committee to Develop Specifications for the Training of a Teacher of Secondary Mathematics, Michigan Council of Teachers of Mathematics. (1976). A program for training mathematics teachers. Mathematics Teacher, 69, 74-78.

Crouse, R. (1974). A successful project for a secondary mathematics methods class. School Science and Mathematics, 74, 321-324.

Davidson, N. (1977). A demonstration of terrible teaching techniques. Mathematics Teacher, 70, 545-546.

Davis, E. J. (1984). Teacher education: helping preservice teachers to teach mathematical concepts. Arithmetic Teacher, 31(9), 8-9.

Dienes, Z. P. (1970). Comments on some problems of teacher education in mathematics. Arithmetic Teacher, 17(3), 263-269.

Driscoll, M. (1986). Effective teaching. Arithmetic Teacher, 33(9), pp. 19, 48.

Farmer, W. A., Jr., & Farrell, M. A. (1972). Pilot study in mathematics and science teacher education. School Science and Mathematics, 72, n 9, 772-776.

Feldman, K. A. (1976). The superior college teacher from the students´ view. Research in Higher Education, 5, 243-288.

Flanagan, J. C. (1954). The critical incident technique. Psychological Bulletin, 51, 327-358.

Freudenthal, H. (1977). Teacher training--an experimental philosophy. Educational Studies in Mathematics, 8, 369-376.

Fuller, F. F. (1969). Concerns of teachers: a developmental conceptualization. American Educational Research Journal, 6, 207-226.

Gage, N. L. (1984). What do we know about teaching effectiveness?. Phi Delta Kappan, 66, 87-93.

Good, T. L., & Grouws, D. A. (1981). Process-product research. In Elizabeth Fennema (Ed.), Mathematics Education Research, Implications for the 80´s (pp. 82-91). Alexandria, Virginia: National Council of Teachers of Mathematics.

Greenberg, J. D. (1983). The case for teacher education: open and shut. Journal of Teacher Education, 34(4), 2-5.

Grouws, D. A. (1985). Research on the teaching of mathematics. In Alan Bell, Brian Low, & Jeremy Kilpatrick (Eds.), Theory, Research and Practise in Mathematical Education (pp. 47-59). Nottingham, UK: Shell Centre for Mathematical Education.

Hanna, G. S., Hoyt, D. P., & Aubrecht, J. H. (1983). Identifying and adjusting for biases in student evaluations of instruction: implications for validity. Educational and Psychological Measurement, 43, 1175-1185.

Hativa, N. (1984). Good teaching of mathematics as perceived by undergraduate students. International Journal of Mathematical Education in Science and Technology, 15, 605-615.

Hativa, N. (1984). Sources for learning mathematics in undergraduate university courses. International Journal of Mathematical Education in Science and Technology, 15, 375-380.

Hawley, W. D. (1984). Teacher education that promotes educational excellence: how to know it when you see it. The Review of Education, 10, 96-99.

House, P. A., & Post, T. R. (1984). Considerations for designing assessment programmes for teacher education. In Robert Morris (Ed.), Studies in Mathematics Education Volume 3 (pp. 153-172). Paris, France: Unesco.

Iannaccone, L. (1963). Student teaching: a transitional stage in the making of a teacher. Theory Into Practice, 2, 73-80.

Jones, J. (1981). Students´ models of university teaching. Higher Education, 10, 529-549.

Joyce, B., & Clift, R. T. (1985). Reforming teacher education. Education Digest, 50(5), 44-47.

Leake, L., Jr. (1976). A model for a methods course. School Science and Mathematics, 76, 193-199.

Lipsey, S. I. (1972). Student teachers ask for help. Mathematics Teacher, 65, 137-138.

Lyons, G. (1980). Why teachers can´t teach. Phi Delta Kappan, 62, 108-112.

McQualter, J. W. (1986). Becoming a mathematics teacher: the use of personal construct theory. Educational Studies in Mathematics, 17, 1-14.

Medlin, D. S. (1984). Teacher training and the improvement of public education. American Education, 20(6), 5-7.

Miron, M., & Segal, E. (1978). The good university teacher as perceived by the students. Higher Education, 7, 27-34.

Murray, J. S. (1982). The extended program for teacher training: a procedural critique. Journal of Teacher Education, 33(5), 2-5.

NCTM Commission on Preservice Education of Teachers of Mathematics. (1973). The guidelines for the preparation of teachers of mathematics. Arithmetic Teacher, 20, 705-707.

O´Daffer, P. G. (1984). Teacher education: helping preservice teachers develop and awareness of curricular issues. Arithmetic Teacher, 31(9), 6-8.

Placek, J. H. (1983). Conceptions of success in teaching: busy, happy and good? In Thomas Templin & Janice Olson (Eds.), Teaching in Physical Education (pp. 46-56). Big Ten Body of Knowledge Symposium Series, Volume 14.

Placek, J. H., & Dodds, P. (in press). A Critical Incident Study of Preservice Teachers´ Beliefs about Teaching Success and Failure. Research Quarterly for Exercise and Sport.

Queen, J. A., & Gretes, J. A. (1982). First-year teachers´ perceptions of their preservice training. Phi Delta Kappan, 64, 215-216.

Roehler, L. R., & Duffy, G. G. (1981). Classroom teaching is more than opportunity to learn. Journal of Teacher Education, 32(6), 7-11.

Roth, B. (1984). Alternative futures for teacher education. Action in Teacher Education, 6(4), 1-5.

Rubba, P. A., & Becker, J. P. (1985). Qualities secondary school principals examine when hiring mathematics and science teachers. School Science and Mathematics, 85, 271-278.

Schempp, P. G. (1983). Learning the role: the transformation from student to teacher. In Thomas Templin & Janice Olson (Eds.), Teaching in Physical Education (pp. 109-117), Big Ten Body of Knowledge Symposium Series, Volume 14.

Schroeder, T. L., & Frame, M. L. (1986). The preparation and continuing education of mathematics teachers in Alberta: a status survey and needs assessment. Edmonton, Alberta: Mathematics Council of the Alberta Teachers' Association.

Shafer, D. M. (1969). A proposal for the mathematics methods course. Mathematics Teacher, 62, 623-627.

Sherrill, J. M. (1973). Pre-service mathematics education: what is required and what elementary school teachers feel should be required. School Science and Mathematics, 73, 224-228.

Shulman, L. S. (1986). Those who understand: knowledge growth in teaching. Educational Researcher, 15(2), 4-14.

Suydam, M. N. (1983). Teaching effectiveness. Arithmetic Teacher, 31(2), 3.

Swan, M. D., & Jones, O. E. (1969). Preservice teachers clarify mathematical percepts through field experiences. Arithmetic Teacher, 16, 643-645.

Tafel, L. S. (1984). A future paradigm for teacher education. Action in Teacher Education, 6(1-2), 1-6.

Trafton, P. R. (1980). One point of view: effective instruction and productive learning. Arithmetic Teacher, 28(4), 4.

Walker, R. (1980). The conduct of educational case studies: ethics, theory and procedures. In W. B. Dockrell & David Hamilton (Eds.), Rethinking Case Studies (pp. 30-63). Toronto: Hodder and Stoughton.

Watts, D. (1982). Can campus-based preservice teacher education survive? part I. Journal of Teacher Education. 33(1), 50-53.

Watts, D. (1982). Can campus-based preservice teacher education survive? part II: professional knowledge and professional studies. Journal of Teacher Education, 33(2), 37-41.

Watts, D. (1982). Can campus-based preservice teacher education survive? part III. Journal of Teacher Education, 33(3), 48-52.

Watts, D. (1982). Can campus-based preservice teacher education survive? part IV: accreditation and certification. _Journal of Teacher Education_, _33_(4), 35-39.

Westerman, W. S., Jr. (1984). Colleges of education must help in the quest for excellence. _The Education Digest_, _49_(5), 10-11.

Wisniewski, R. (1983). Too many schools of education? Too little scholarship? _The Education Digest_, _49_(3), 32-35.

Young, S. L. (1983). Teacher education: how teacher educators can use manipulative materials with pre-service teachers. _Arithmetic Teacher_, _31_(4), 12-13.

Zeichner, K. M. (1983). Alternative paradigms of teacher education. _Journal of Teacher Education_, _34_(3), 3-9.

RELATED READINGS

Baird, J. R. (1986). Learning and teaching: The need for change. In J. R. Baird & I. J. Mitchell (Eds.), *Improving the Quality of Teaching and Learning* (pp. 8-15). Melbourne: Monash University Printing.

Balka, D. S. (1974). Early experiences in teaching secondary school mathematics. *School Science and Mathematics*, *74*, 55-56.

Bender, P. (1984). Mathematics teachers should have the conviction that every individual should be taught mathematics. *A Collection of Papers on Pre-Service Teacher Education* (pp. 105-109). Adelaide: Action Group 6, ICME 5.

Brodbelt, S. (1984). Considerations for redesigning teacher education. *The Clearing House*, *58*, 122-126.

Clarke, D., & Blane, D. (1984). An evaluation of pre-service mathematics teacher education at Monash University. *A Collection of Papers on Pre-Service Teacher Education* (pp. 187-196). Adelaide: Action Group 6, ICME 5.

Collea, F. P., & Pagni, D. L. (1973). Another view of a methods course: an effective approach. *School Science and Mathematics*, *73*, 707-710.

Cooney, T. J. (1985). A beginning teacher's view of problem solving. *Journal for Research in Mathematics Education*, *16*, 324-336.

Farrell, M. A. (1979). Competency identification and assessment in mathematics teacher education: Some issues. *Mathematics Teacher*, *72*, 571-579.

Feinstein, I. K. (1972). Preparation for effective mathematics teaching in the inner city. *Mathematics Teacher*, *65*, 79-85.

Fendel, D. (1980). An experiment in teacher training. *School Science and Mathematics*, *80*, 407-412.

Galbraith, P. L. (1984). Attitudes to mathematics of beginning undergraduates and prospective teachers: Some implications for education. *Higher Education*, *13*, 675-685.

Goldhammer, K. (1981). Teacher education: Reality, hope, and promise. Journal of Teacher Education, 32(5), 25-29.

Good, T. L., & Grouws, D. A. (1979). The Missouri mathematics effectiveness project: An experimental study in fourth-grade classrooms. Journal of Educational Psychology, 71, 355-362.

Haberman, M. (1981). Teacher education and the expanded role of the school. Journal of Teacher Education, 32(4), 2.

Hall, G. E., & Hord, S. M. (1981). A national agenda for research in teacher education for the 1980s. Journal of Teacher Education, 32(2), 4-8.

Hall, L. T. Jr. (1986). Looking back to 1985 from 1995. Arithmetic Teacher, 33(7), 47-49.

Hanna, G. S., Hoyt, D. P., & Aubrecht, J. D. (1983). Identifying and adjusting for biases in student evaluations of instruction: implications for validity. Educational and Psychological Measurement, 43, 1175-1185.

Ishler, R. E. (1984). Requirements for admission to and graduation from teacher education. Phi Delta Kappan, 66, 121-122.

Lerch, H. H. (1974). Pre-service teachers evaluate participatory experiences in a mathematics laboratory with children. School Science and Mathematics, 74, 95-103.

Lucas, C. J. (1985). Why teacher education needs educational foundations courses. The Education Digest, 50(5), 48-49.

McArdle, R. J., & Schuttenberg, E. M. (1984). A positive strategy for teacher education. The Teacher Educator, 19(4), 25-28.

Nisbet, S. (1984). Attitude change in prospective secondary mathematics teachers: A follow-up report. A Collection of Papers on Pre-Service Teacher Education (pp. 207-214). Adelaide: Action Group 6, ICME 5.

Research Advisory Committee. (1984). Mathematics education research: 1983 in review. Journal for Research in Mathematics Education, 15, 316-318.

Rising, G. R. (1969). The sorry state of mathematics teacher education. Arithmetic Teacher, 16, 296-300.

Rotberg, I. C. (1984). A new perspective on math and science education. Phi Delta Kappan, 65, 668-673.

Roth, R. A. (1983). The status of the profession: selected characteristics and criticisms of teacher education and teaching. The Teacher Educator, 19(2), 2-10.

Samson, G. E., Borger, J. B., Weinstein, T., & Walberg, H. J. (1984). Pre-teaching experiences and attitudes: A quantitative synthesis. Journal of Research and Development in Education, 17(4), 52-56.

Sandoval, H. F. (1984). Teacher training in computer skills: A call for redefinition. Educational Technology, 24(10), 29-31.

Scandura, J. M. (1970). Research basis for mathematics education. The High School Journal, 53, 264-280.

Selkirk, K. E. (1984). A workbook for mathematics teacher education. A Collection of Papers on Pre-Service Teacher Education (pp. 117-125). Adelaide: Action Group 6, ICME 5.

Sherard, W. H., III. (1985). Teacher education: Mathematics methods in a laboratory setting. Arithmetic Teacher, 33, 48-49.

Silverman, H., & Silvia, E. (1975). Teacher training within a liberal arts university. School Science and Mathematics, 75, 123-128.

Stake, R. E. (1978). The case study method in social inquiry. Educational Researcher, 7(2), 5-8.

Stevens, D. J. (1982). Mathematics methods: Pre-student teaching model. Journal of Teacher Education, 33(1), 18-21.

Thornton, C. D. (1977). An evaluation of the mathematics - methods program involving the study of teaching characteristics and pupil achievement in mathematics. Journal for Research in Mathematics Education, 8, 17-25.

Walker, R. (1983). Three good reasons for not doing case studies in curriculum research. Journal of Curriculum Studies, 15, 155-165.

Weaver, W. T. (1984). Solving the problem of teacher quality, part 1. Phi Delta Kappan, 66, 108-115.

Wright, J. P., Silvern, S. B., & Burkhalter, B. B. (1982). An evaluation of teacher input in field - based instruction. Journal of Research and Development in Education, 15(2), 34-37.

APPENDIX A
Success Critical Incidence Form

Name:________________________________ Female:____ Male:____
Status: Trans. Stu.: ___ 2nd Deg.: ___ Dip.: ___ Cont: ___
Grade Level Student Teaching: Jr High: ___ Sr High: ___

Complete these questions with respect to the specific instance on this form:

Class: ____________________ Date: ____________________

Topic: ____

During the past week you have been student teaching in a mathematics classroom. Reflect on a particular incident that YOU feel was indicative of successful teaching. Describe the specific instance (or instances), the setting in which it occurred, and some detail about what made it successful. Write in specific terms rather than generalities. Use only actual instances that you remember and can describe. Thank you. (Use the back if necessary).

Nonsuccess Critical Incidence Form

Name: ____________________ Female: ___ Male: ___
Status: Trans. Stu.: ___ 2nd Deg.: ___ Dip.: ___ Cont: ___
Grade Level Student Teaching: Jr High: ___ Sr High: ___

Complete these questions with respect to the specific instance on this form:

Class: ____________________ Date: ____________________

Topic: ____________________

During the past week you have been student teaching in a mathematics classroom. Reflect on a particular incident that YOU feel was indicative of nonsuccessful teaching. Describe the specific instance (or instances), the setting in which it occurred, and some detail about what made it nonsuccessful. Write in specific terms rather than generalities. Use only actual instances that you remember and can describe. Thank you. (Use the back if necessary).

APPENDIX B
Release Form

By affixing my name to the statement below, I agree to participate in the study as described.

I agree to participate in the study "A Case Study of a Mathematics Methods Program". Participation entails the completion, in writing, of 3 successful critical incidence forms and 3 nonsuccessful critical incidence forms, one of each per week for each student teaching round. Forms are to be returned to the researcher at the end of each student teaching round.

If selected to participate in the second phase of the study, I further agree to a series of taped interviews pertaining to the critical incidents collected in Phase One of the study.

I fully understand that any information provided to the researcher by written or spoken word is released for his use in the written thesis document to be quoted or discussed.

I am aware that I can withdraw from the study at any time if necessary.

I fully understand that all information provided is confidential and that every effort will be made to protect my identity so that no repercussions may ever be felt by me. No identities will be revealed or real names used.

Signature: ______________________________

Date: ___________________________________

Note: If you wish a brief summary of the results at the conclusion of the study, it will be forwarded to you at the address below:

____

____

____

APPENDIX C
Interview Questions

Student Teacher Interview Questions

[1] How well did you enjoy your junior high student teaching experience? Why?

[2] When you were student teaching in a junior high classroom, what things gave you the best feeling towards teaching? Why?

[3] When you were student teaching in a junior high classroom, what things did you worry about the most? Why?

[4] What are you most looking forward to in the senior high student teaching round?

[5] What are you most concerned about in the senior high student teaching round?

[6] What are the most important skills or attributes a mathematics teacher should have? Why?

[7] What are the most important skills or attributes a student teacher should have? Why? Are these the same as in Question [6]?

[8] Do you think it would help to have a previous degree and then get an education degree? What difference would it make? How or Why?

[9] During the first 3 weeks with Dr. Jones, what things did he spend the most time discussing (what did he emphasize)? Please be specific.

[10] What things did he mention but not really stress?

[11] What things (topics) do you wish he had emphasized more? Why?

[12] What do you wish he had addressed? Why?

[13] What things do you wish he had emphasized less? Why?

[14] What things did Dr. Jones discuss that helped you while student teaching?

[15] What things did Dr. Jones discuss that didn´t help you while student teaching?

[16] What things did Dr. Jones discuss that you tried and found to work? Why did they work?

[17] What things did Dr. Jones discuss that you tried and found not to work? Why didn´t they work?

[18] If you were going to teach a mathematics methods course, what topics would you teach?

[19] In order to have a successful experience teaching junior high mathematics, what advice would you give another student teacher?

[20] What do you think the job of the junior high mathematics teacher is?

[21] When things go wrong in the classroom, whose fault is it? How about when good things happen?

[22] What emotions, if any, is it common for a student teacher to feel while student teaching?

[23] How do you measure learning in your students?

[24] What is the major difference, if any, between teaching in the junior high school and the senior high school?

[25] Most student teachers report Planning and Preparation and Discipline as the things that go wrong most often when teaching in the junior high. Do you think this is reasonable? Why do you think it is so? Are they also the most important in the senior high?

[26] Most student teachers report that Student Acceptance of Teaching Role, Teaching Methods, and Discipline are most important for successful teaching in the junior high. Do you think these things are the most important? Why? Are they also the most important in the senior high?

[27] Why do you think that student teachers concentrate so rarely on learning? What do you think could be done to improve this?

[28] Do you think it is reasonable to say that student teachers progress through three stages as they become teachers: concern for self, concern for classroom, concern for student learning? Why or why not?

[29] Do you think males will accept some things as more important than other things while student teaching? Why things, if any? How about females?

[30] What effect has Dr. Jones' class had on you?

[31] What effect has your cooperating teacher had on you?

Methods Course Instructor Interview Questions

Content Related:

[1] What was the content of the EdCI 364/365 course? Please describe each major topic.
[2] Why did you select these topics?
[3] Of what benefit do you think these were for the students?
[4] How did you sequence them?
[5] In what way were these topics related to the students' field work?

Callback:

[6] What was your intended purpose for the callback?
[7] How were the callbacks operated?
[8] Did you achieve your objective for these callbacks?
[9] Of what benefit are they for the preservice teachers?

Organizational Structure:

[10] What other components were involved in your course design? How did they link to your basic course? In what way did they link the field experience?
[11] Why did you include them?
[12] How were they organized and run?
[13] What topics did they cover?

General:

[14] How would you compare this group of preservice teachers to past classes? How would their differences contribute to exceptional instances during student teaching?
[15] Look back on the course. How would you change it? Why?
[16] In general, what do you think the students got out of this course? (Perhaps in terms of philosophy development, teaching methods/strategies, attitude development, etc.)
[17] How much transfer do you think takes place between their coursework on campus and their student teaching experience? Is it the same for the senior high as for the junior high?
[18] Why is this course taught? (Consider this both from a personal perspective and from an institutional perspective). Are these goals achieved?

APPENDIX D
Interview with Anne

April 24.

INTERVIEWER: [1] How well did you enjoy your senior high student teaching experience? Why?

ANNE: It went really well. The major reason was that I was much more comfortable with my cooperating teacher this round. Last round we did not get along well. I had a lot of problems with it. So, it was just the fact that it was a change and that we started off with a better relationship, it made me more comfortable and everything seemed to go a little bit better.

INTERVIEWER: Why didn´t you get along with the first teacher?

ANNE: I´m not really sure. He was a real hard-liner when it came to discipline. He had the idea that you had to come down hard the first time. He seemed to have a very negative viewpoint towards the children whereas I come from the very opposite with the most humanistic view towards the children. I felt very constrained and pressured to adopt his teaching style. I don´t know whether it was him or me or both. Things didn´t go well and the whole round was not happy or comfortable at all.

INTERVIEWER: You say you felt pressured to adopt his teaching style. That didn´t happen the second round?

ANNE: No, she let me do what I felt was necessary in class. She would talk about it with me, but she would not give me orders, just suggestions. She left it up to me. She did not act overly disturbed when I tried something that she had recommended against. If it didn´t go well, she just said "Well, there you go, see you´ve learned". She did not come down hard about it. It was a much more comfortable experience.

INTERVIEWER: What do you think caused that feeling of pressure to conform with your first cooperating teacher?

ANNE: I think it was his personality. I think it was the way that he thinks teaching should be, and that all teaching should be. I didn´t agree.

INTERVIEWER: What other reasons might there be that you liked you senior high round better than the junior high round?

ANNE: The kids are more mature and you can appeal to their maturity to help them behave. I don't like coming down hard on kids and kicking them out of class. I admit that I still have trouble with discipline in my classes. It was much easier to work with more mature students that were there to learn. My classes were the matric stream so they were keen, bright kids who wanted to go on and further their education. They were interested in learning their math. At the junior high level it was a real battle sometimes to make these kids pay attention at all. The curiosity and interest was just not there at all some days. It was a real battle just to get started. At the senior high level these students (and I did have some exceptional classes) these kids were keen and that helped a lot.

INTERVIEWER: [2] When you were student teaching in a senior high classroom, what things gave you the best feeling towards teaching? Why?

ANNE: When the kids finally understand. The students who never have trouble could learn without me. I'm not doing anything that is specifically good for them. I don't feel that I have accomplished anything with them because they will learn with any teacher. But with the average students, the ones who fall into the cracks in the floor, the borderline students, when they are finally confident enough to say "I'm so confused. I don't understand." When you finally go through it and they do understand, that's a great feeling, that's what teaching is all about. When this happens you're just walking on air.

INTERVIEWER: [3] When you were student teaching in a senior high classroom, what things did you worry about the most? Why?

ANNE: Before getting up there, how prepared I was.

INTERVIEWER: What do you mean by being prepared?

ANNE: Being able to handle questions. I have a good mathematics background, and I thought I knew the mathematics cold, but every now and then you get a question that you haven't a clue how to answer. After you get a few of them it starts to worry you a bit. Being able to handle the students. There is still some misbehavior that I don't have a clue what I should do about it. You're up there on display, you're nervous, and the kids know it, its a really tough situation. I found that where I worried a lot before, as soon as I started teaching, I wasn´t worried at all. I found I couldn´t worry and teach at the same time. You would worry up until you got up there, and then you would just do it. Actors probably feel the same way with their performances, once you´re up there, you´re just going to do it.

INTERVIEWER: You have talked here about preparation. What kind of preparation do you mean, writing lesson plans?

ANNE: Yes lesson plans, but also knowing the students. I had one class where I consistently gave them too much lecture time. We had 81 minute classes and I really wanted to make sure that they understood this material cold. I gave them lots of examples and notes and the kids started to drift after a while. I think I was pushing too hard to reach every single student. I was overly worried about being prepared for that group. But there was another group where I organized a careful presentation, gave it to them, and they didn´t have a clue what they were doing. You´re up there wondering how else you could have taught it. After that happened the first time, you start to wonder what you should do and then you develop the ability to think on your feet. You have to be able to get an idea of where the kid´s problem is and be prepared for their types of misunderstandings. I have so much to learn. This is one thing that I´ve talked to my cooperating teacher about, and she would say "This is where they´re running into trouble. This is where they´re making their mistakes". She knows this because she has been teaching for years and has had the experience to see it. Because I don´t know this, even after several revisions of the lesson plan when I´m sure the students will understand, they still sometimes don´t. So, being prepared to know about where they will have their problems is important.

INTERVIEWER: You have talked about lesson planning, knowing your content and being able to teach it. Do you worry about all of these things when you´re teaching in the senior high?

ANNE: Yes, you worry about everything.

INTERVIEWER: Do you worry about these things in the junior high?

ANNE: Not the content. I don´t have to prepare for this material. I sometimes found though that even at the Grade 10 or 11 level when I though I knew it all, sometimes I didn´t. There is a lot that I have forgotten.

INTERVIEWER: You talked about discipline in the junior high and the senior high. [24] What is the major difference, if any, between teaching in the junior high school and the senior high school?

ANNE: In the junior high they are that much younger, very energetic and lively. But this can get out of control so easily because they are so energetic and full of life. Sometimes its overwhelming. If the kids are energetic but still respectful of the teacher, then the class will go alright. But if they aren´t, and that was what was happening in my classes, it was just chaos. It was impossible to handle. Once you´ve lost the control of the class, there is no way you can teach. It was a real battle. In the senior high round there was a lot more respect from all of the students. They come to you with a few more years of maturity and training and an understanding of why you need to go to school. They have more understanding why it is important and are willing to put out with that understanding. In terms of discipline, it is much easier to handle kids in the senior high.

INTERVIEWER: In what ways, besides discipline, is teaching in the senior high different from teaching in the junior high?

ANNE: In the senior high round, the students are very well matched in ability. The students have been streamed a little bit more. It is a lot easier to teach to, you aren´t teaching to all of the extremes. In my junior high round, I had students that were going to the catalyst or challenge program and I would only see them twice a week. They would catch on to my material and then go ahead without any trouble. Teaching them and keeping them interested is one thing, but at the same time I had the students who will never progress beyond Math 15. Teaching for all levels was difficult because they haven´t been streamed as much.

INTERVIEWER: [4] What were you most looking forward to in the senior high student teaching round?

ANNE: Nothing. I wasn´t looking forward to it at all. It was dread.

INTERVIEWER: Why were you so afraid?

ANNE: Because I had such a rotten experience last time. Another four weeks of this, I didn´t know if I could handle it.

INTERVIEWER: Did you think it would be the same as the round before?

ANNE: Well, I had no idea. The school I went to was out in Brownville and there are three high schools there. There was a lot of rivalry and a lot of rumors about what went on in these other schools and what the people were like in these other schools. It was baseless, but it was part of what I had heard and grown up with. It was also a strange thought to realize that some of the kids I was teaching I would know; they could be my neighbors. I don´t want to be teaching people that I know that well. These were some of the things I worried about.

INTERVIEWER: [5] What were you most concerned about in the senior high student teaching round?

ANNE: Getting a good evaluation. Its kind of sad, but that´s the truth. Getting through it, that was really it.

INTERVIEWER: You are describing a survival attitude to me. Say more about that.

ANNE: Student teaching, there is so much riding on it. I know that ideally you should be there to learn how to teach and to take the experience and learn from it. In fact, there is a lot more to it than that. You are getting an evaluation, you are being graded, tested. This is determining whether or not you will ever be hired. With the way things are right now and teachers being laid off, the competition is incredible. There were 10 applicants for every job in Baffin Island. Its incredible to think that I can´t even get in at Baffin Island. Its really tough. I think more now than ever before, the student teaching evaluation factor makes it difficult to approach your teaching with a perspective towards learning.

INTERVIEWER: [6] What are the most important skills or attributes a mathematics teacher should have? Why?

ANNE: I wonder why you say specifically mathematics teacher? I will answer the question with respect to a teacher in general. I think the most important skill is organization. I found this to be a problem. I think that it is really a very important quality that a teacher should have in order to teach well. I also think empathy is important, being able to feel for the students. When you´re up in front of the class, you´re in control, you have power. Its a very different feeling now that I have toward teaching than when I was a student myself. I can see how its very easy to foster the feelings that develop the attitude of being in control and being a disciplinarian and authoritarian. You have to remember that the students in your classroom are people and should be treated that way. There are so many teachers in our system that have been there for so long, and they dehumanize our students. Its really awful in there, and difficult sometimes to remember that these are people and we should be nice to them. They are here trying to learn, give them a break sometimes.

INTERVIEWER: You have mentioned two things. Lets go back and look at them again. You mentioned organization, why do you think organization is important?

ANNE: Without it you will go crazy. I found it was important to keep track of everything every day. I kept a binder that had all my notes, worksheets, what was handed in, keys, everything. If a student who has been sick comes to ask what you did that day, if you are not organized then you cannot answer him. This happened to me once or twice. The only thing that saved me were the organizing schemes that the cooperating teacher had. Her methods are just great. I just love them and have to learn how emulate and adopt them. They were very useful techniques. Its all really management related things. It doesn´t have much to do with teaching, although organizing comes in there too. If you present a topic in an organized manner and your blackboard work is organized, then when the kids go back to study, the notes are useful, it helps them to review. I don´t think its as important to be organized in the teaching, because I think they can learn without it, but its helpful for the bookkeeping and managerial aspects of teaching. I think it helps the kids later on. It gives them a good role model. Organization is important and if they see it in their teacher, it helps them develop it too.

INTERVIEWER: How do we teach student teachers to be organized?

ANNE: This is something that you should do. I think the best way is to show different types of organization. I´ve had three different organization models, my cooperating teachers, but I´ve learned the most from the last because she was the most organized. The first two both seemed quite wishy-washy and things just seemed to flow around them. They kept the kind of office where papers were everywhere and who knows where anything is. If I were that teacher, I would feel very harassed. I like to have things well structured and everything in its place. This makes the incidental things in teacher go a lot smoother. I think the best way to teach student teachers to be organized, to manage a classroom and the bookkeeping associated with teaching, is to present different ways to do it. You never even see a mark sheet at university. My cooperating teacher had some great ideas, and these tricks were very helpful with the day to day routines.

Except by example I don´t know how you would show a student teacher the organization of a classroom.

INTERVIEWER: You mentioned empathy as well. Why is that important?

ANNE: Its too easy to get up there in front of the class and say "This is what math is, this is how you do it, and you have to do it my way or you fail". That attitude is the way a lot of students perceive school. When I went through school myself I asked "Why do these people have authority over me? What gives them the right? Is it right?" I had a lot of problems with this. The teachers who treated me with respect, had my respect. They also happen to be in my opinion more effective teachers. If you have this attitude of respect for your students you will want to go further for them and be more concerned about what they have learned. You will want to do the best job that you can. Its illogical to think that you want to be a good and effective teacher, but at the same time you don´t like your students. Its illogical for you to want them to feel low and to put yourself above them if you want the best for them. I don´t think these are compatible attitudes. I´m not sure empathy will foster good teaching skills and effective teaching, but I think you can´t have one without the other.

INTERVIEWER: You have mentioned that a key aspect of teaching is dealing with the feelings of authority. Did you deal with these feelings? How?

ANNE: It was tough. I think the kids have to develop trust and respect you as a student teacher, and that´s the biggest stumbling block. You are only there for four weeks. They know you´re only a student teacher, and they know you´re new at this and they are going to want to test you. They don´t want to respect your authority. You enter into the classroom with a low level in their opinion, so most student teachers want to develop control and authority quickly in the classroom. I think this is fostered in the underground rumor mill rather than in the courses. This is not brought up very often in the courses, but it does when talking to other education students. So you worry about how they will respect you and how you will make them respect you. Because of this, I end up feeling that I am dehumanizing the student and taking advantage of my position over them. When students do things only because you say they should, that isn´t what teaching is all about. A teacher should be required to support her teaching. This is something that Dr. Jones brought up in class and it was very interesting. He said you should answer to a student who asks "Why? How? Please Explain!" by responding "Because!". We weren´t sure if he was serious, it seemed like such a domineering attitude and so oppressive. We finally decided he doesn´t really feel this way about it, he just wanted us to think about it. Sometimes its really tough in the classroom because we´re not sure if we should accept what the professor says. But, being able to go into the classroom and approach teaching not through control of the students but through helping the students learn something is very different than the common concept of teaching, especially math teaching. Math is so cut and dried. Either you have it right or you have it wrong and there is no inbetween. I think it is really tough in the math class to encourage feelings of success in your students. In other classes they can come up with good ideas, and they are still good ideas even if they don´t work. In the math class, if the kid did it wrong, the kid did it wrong. Students have such an awful attitude toward mathematics; people hate math so much. I think this is so sad. I would love to have kids leaving my classroom thinking "This is so neat. Math is fun."

INTERVIEWER: Are you saying that you think a sense of authority detracts from this?

ANNE: Yes, exactly.

INTERVIEWER: [7] What are the most important skills or attributes a student teacher should have? Why? Are they the same as that of the teacher?

ANNE: They are slightly different I think. Something I don´t have, but that I think is important, is the ability to be relaxed and to feel confident in front of the class. If you are confident, and feel confident, then they will have faith in you as a student teacher. I am awful ~~at~~ it, at least I feel I am. I guess it really comes down to acting, how much of a show can you put on for them. If you´ve got their faith, their trust, then you can learn how to teach. But if you are still struggling with discipline problems and the kids won´t even listen to you, then there is no way you are going to learn how to teach. You are still dealing at the level of getting to first base, opening up communication. If you have the ability to present as a confident, relaxed person right from the start, then that is probably a really helpful thing. Again, I am not. And they know it. I don´t feel confident going up in front of the class. I administered an evaluation the last day, and I´ve been tabulating the results. Its really hilarious to realize how many of them knew how nervous I was. These students knew all along. If you can go into the classroom with confidence, then it makes the learning how to teach so much easier.

INTERVIEWER: Are you saying that portraying confidence is not important for the teacher but it is for the student teacher?

ANNE: No, its just more important for the student teacher. The teacher will develop confidence or leave the profession. After a few years of teaching you have handled a few situations and are more confident. As a student teacher you are going in cold and don't know a thing.

INTERVIEWER: What kinds of situations are you talking about?

ANNE: Last Tuesday the Math 10s wanted to go to a play during period 2 which is our regularly scheduled class time. I didn't really know if I should agree to this or not, but I decided that it was near the end of the unit and that they were doing well. I decided that seeing as it was just a day of review and that most of these kids were keen, they could study at home. I told them I would talk to my cooperating teacher and that she would probably agree. She did agree and we went to the play. It was only about 40 minutes long, and we had a 60 minute period. The students came back into the class for the last 15 minutes, but only about half of them showed up. Fifteen of the 30 kids were out wandering the halls. So what am I supposed to do with these kids now? How do I show them that the rest of the kids aren't going to get away with it. It was an awful situation and I still don't know how I should have handled that appropriately. A teacher will run into this type of situation, almost every type of conceivable problem.

INTERVIEWER: You have a previous degree in mathematics. [8] Do you think it helps to have a previous degree and then get an education degree? What different would it make?

ANNE: Yes, definately. That is the biggest problem with the Faculty of Education, that is does not require enough knowledge of their teachers. This is something that I railed against in high school, educated idiots teaching me. I wondered how much they really knew about their material. The teachers who could demonstrate to me that they knew their material, that they were capable, those were the ones who had my respect. I thought they were better teachers. I had one teacher who bragged about how low his marks were in high school. He bragged about how he got through the Education Faculty with poor marks and poor behavior and I thought it was ridiculous that this person should be here trying to teach me something. The respect for the profession is lacking because of that. There are a lot of incompetent teachers out there. Incompetent not only in teaching skills but in the area in which they are trying to teach. I think that those people who go into education with a previous degree know the material that they are trying to teach, assuming the degree is in their area. I haven´t gone through education without a degree so its hard for me to see both sides of the issue, but I firmly believe a BEd after degree should be the only degree available from this faculty.

INTERVIEWER: You commented though that you too worried about your mathematical knowledge.

ANNE: Yes, but its tough. Its a matter of having to go back and relearn what I learned back then. You learn a lot of short cuts and knowledge that you have built upon. For example, working with fractions. The grade 10s are hopeless with them and I began to wonder what was wrong but then I realized that its just easy for me because I´ve had so much more experience with it. In a way having a degree does detract, but overall its to your advantage.

INTERVIEWER: I have found in earlier stages of this study, that people who have a first degree in math seem to be less sensitive to student learning.

ANNE: I can see this. I can see that people with math degrees have trouble seeing the problems that kids have. One other student teacher commented in class one day that he was the sort of kid who got through math by tooth and nail and so understood the kinds of problems that kids have and thought that he could address those. I thought that was neat, but at the same time he will have students who will excel and wonder what he is doing and how much math he really knows. Because I was the student who excelled, I was one of those who had a low opinion of teachers such as him. I´m not saying that he is a poor teacher or will be, but that the teachers who didn´t have the knowledge in their area lost my respect and I really hated going to their classes. I think a good teacher, even one with a previous degree, will be able to pick up on those problems. In my own evaluation that I´ve been working on, one question was to describe the most obvious teaching strength of this teacher. At least half responded that it was her desire to make everyone understand and her willingness to go over and over it again until we do. I was pleased, because I think that this is important. In my feelings toward teaching, I want all my students to pass and do well. I love the idea of helping them master a concept. I hate the idea of letting them go when they know only 50% of the material. It seems wrong. I think having the degree may detract in that it makes it hard for them to see the problems kids have, but I still think a good teacher will be able to see the problems and work from there.

INTERVIEWER: [9] During the second three weeks with Dr. Jones, what things did he spend the most time discussing (what did he emphasize)? Please be as specific as you can.

ANNE: In general, the thing that he emphasized the most was the debate between understanding and proficiency. One other thing that I think he emphasized was the curriculum. I went away thinking that these two things were what the course was all about.

INTERVIEWER: [10] What things did he mention but not really stress?

ANNE: A lot of things were mentioned. For example, practice. How important is practice? Should we have students do 50 problems of the same type as opposed to making the assignments interesting and motivating? Getting the most out of your homework assignment. This was mentioned briefly, but we didn´t get anywhere with it. Constructivism. The whole idea of philosophies of education were mentioned very briefly, and hardly mentioned at all.

INTERVIEWER: [11] What topics do you wish he had emphasized more? Why?

ANNE: Getting the most out of your homework assignments and helping students to do their homework assignments. Helping students to write tests. Perhaps a little more on the philosophies of education and teaching in general. But not an awful lot, it isn´t really the purpose of the course, but just the side issues that I found interesting. One other thing that was mentioned very briefly and I wish we had spent more time on was discipline. Also management, general bookkeeping skills and the day-to-day running of the class.

INTERVIEWER: I´m trying to understand the balance between the theoretical and the practical things that you would like to have seen taught in the course. Can you comment on that?

ANNE: One of the things that was a part of this course that I thought was just an absolute waste of time was going through the curriculum. Each day we took a new topic and I began to wonder what the purpose of the curriculum guide was. Aren´t we supposed to do this on our own time as teachers? We would also have an hour long lecture on this, and you cannot touch the depth of the content in one hour, it was a real waste of time. I think its the individual person´s responsibility to find out that information. I think the information is available through other textbooks and curriculum guides, we didn´t need to do it. When I went to research my areas I found that there was more than enough information and I could pick and choose among all the different textbooks. I think the responsible teacher will do that and that it is their responsibility. I think having Dr. Jones stand up there and tell us what they do in Grade 11 statistics is a real waste of time. I thought that maybe in a sense it was a practical consideration and he was trying to help us in our next round of student teaching, but I didn´t think it had a place in that course. I also think we did not spend enough time on the practical aspects of teaching in the classroom, for example management skills, dealing with absences and lates, helping a student catch up after they´ve been sick, recording marks, keeping track of individual students´ activities. When do you know if a student has developed a pattern of coming late to class? Obviously you have to keep track of it at some point.

INTERVIEWER: What is the purpose of this class then?

ANNE: As it was, I don´t really know. I was really disappointed with the course and would be much more practical preparation for teaching. I found it to be full of useless topics like covering the curriculum. As it should be, I think it should be much more practical preparation for teaching. You could say that there are other CI courses for, like 352. I think I had a particularly good 352 course compared to others, but even still I feel there is still so much more I have to learn about handling the practical problems of the classroom. When are you ever taught to do it? Never! How do these teachers get out and know when to keep track of one student in particular. My cooperating teacher had a file, and when he felt it was appropriate he would put a piece of paper in the file describing an incident. This way you have a record of it when talking to parents, students and the administration. You don´t have to call back vaguely into your memory. Having a hard record is important. This is never mentioned in the faculty. Keeping track of marks. What is a good way to do it? I would like more helpful hints. I don´t even know how wide spread they are in the teaching profession, maybe my experience is an isolated occurrence. I have yet to have and practical help such as this and frankly I´m a little disappointed. I thought there would be more. I think the course should focus more on this.

INTERVIEWER: How can you tell when what you are being told is practical or theoretical?

ANNE: You can´t until you try it. You can´t until you get out of Dr. Jones´ course. You take all these ideas and methods out and try them. When you decide that a certain idea is not one that you would use in your teaching simply because you do not have time to touch upon it, then you know that it was theory and it was nice to hear but it has no practical purpose here. I suppose you say its right in saying that its hindsight, and I can tell you that the course wasn´t practical.

INTERVIEWER: Is practicality the same thing as usability?

ANNE: No. You can have a practical suggestion that is useless. You can have a practical suggestion that will work for only one type of person. A suggestion one of my cooperating teachers made to me was to yell at the students. This is a practical suggestion, but it wasn´t useful to me at all. I don´t like doing it, I don´t do it well, and it would bother me a lot. So it was a practical suggestion but it was useless. I don´t really know if the usability of a suggestion is dependent upon the person or if there are some practical hints that are useful for everyone.

INTERVIEWER: Then how do we know if something is practical or theoretical?

ANNE: I don´t know.

INTERVIEWER: [12] What do you wish he had addressed? These are things that he left out that you wish he would have talked about.

ANNE: Classroom management, classroom organization, bookkeeping, the managerial aspects of a class. I would also have liked more ideas on the useful way to teach a topic. When we had to stand up and give our own presentation on what´s a good way to teach conics or another section, that was one minor topic that was being pulled out of one lesson. It would be nice to have more exposure to that sort of thing through people who are actually out there teaching. These people could come in and say "When I teach this I find it particularly useful to do this, or use this type of model". Being forced, as we were, to pull these ideas out of a hat, it was tough, but the fact that we had to go and try to find them was really useful because I am going to have to do when I´m out there teaching. I´ll need to look for ideas that can help my students understand factoring polynomials and such. It is not easy. Having a teacher come into the classroom who has been teaching for awhile and could discuss this sort of thing would be useful. We didn´t discuss these things enough.

INTERVIEWER: [13] What things do you wish he had emphasized less? Why?

ANNE: The curriculum. Half of our lecture every day talked about our curriculum.

INTERVIEWER: I´m confused about the difference between the curriculum and the methods to teach the curriculum. What was the difference in the way these things were covered in your course?

ANNE: The way the course was split was that the first hour would be spent talking about the curriculum, and then we would have our individual presentations and then another 40 minutes on methodology. The first hour we would talk about what topics were found in the curriculum guide. He would spend a great deal of time on this. It seems useless, because it was an exact duplicate of the curriculum guide. All we got was the curriculum guide summarized in Dr. Jones´ words. I found that there really wasn´t much point in this. The methodology included the planning and preparation, how you plan, questioning techniques, strategies to teach a specific topic. For example, when teaching factoring, is it a useful idea to use the idea of a square, where the length and width are the factors of the polynomial and the area is the polynomial itself. This is a method in teaching factoring of polynomials. General classroom methodology, such as questioning techniques, homework, and structuring of a lesson. These are general teaching skills. The curriculum was just the content of the mathematics courses taught in high school. We simply can´t cover every topic in the mathematics curriculum in the three weeks we have on campus, its simply ridiculous.

INTERVIEWER: You have described two sections: the curriculum aspect and the methodology aspect of teaching mathematics. Did he cover them in separate sections or did he cover them together?

ANNE: In separate sections. We would have an hour on the curriculum and an hour on the methodology. Sometimes the methodology would go with the curriculum topic, but sometimes it would be a general topic. For example, the uses of computers in the classroom. He would talk about computers not just in the curriculum today but in all areas of teaching mathematics. But still, I didn´t find it helpful, not at all.

INTERVIEWER: [14] What things did Dr. Jones discuss that helped you while student teaching? and [16] What things did Dr, Jones discuss that you tried and found to work? Why did they work?

ANNE: When teaching factoring, illustrating a polynomial as the area of a square with the sides of the square being the factors of the polynomial was one teaching strategy that I used. I tried it and I think it would have worked with a little more application. As it was, we were really rushed so I never really got to work with it. I also tried some general teaching strategies. At one point we mentioned the star method of questioning, and when you question students, what do you do. I found this sort of thing very helpful.

INTERVIEWER: [15] What things did Dr. Jones discuss that didn´t help you while student teaching? and [17] What things did Dr. Jones discuss that you tried and found not to work? Why didn´t they work?

ANNE: The lesson plan format that Dr. Jones suggested is one that I tried and found not entirely useful. I found the do-now exercise to be a waste of time and so I dropped it after trying it. There were 13 headings in that lesson plan format, and some of the headings seemed to repeat each other and several of which were unnecessary. When I tried forcing myself to use this lesson plan format, I found that I was spending more time thinking of things to write down rather than what I was going to teach and how I was going to teach it. When I finally gave up, I changed to format to something I liked, and I found things went a lot better after that. I can´t think of anything else.

INTERVIEWER: [18] If you were going to teach a mathematics methods course, what topics would you teach? Why?

ANNE: I think I would include class organization skills that every teacher should have, such as keeping track of record, keeping track of student activities, how do you handle the student who comes in the next day. My cooperating teacher keeps five boxes on a side shelf. A student who is away knows that he or she can get the material missed from the box for their class. This allows for minimum disruption of the class. Another thing that she did was to give advance notice of every quiz and test. I don´t agree with giving surprise quizzes, and neither does she. The students know when a quiz or test is coming and if they are absent the day before they know they have to catch up on the material before the test. So, you don´t have problems with students writing quizzes three weeks later because they have been putting it off. To have this sort of system set up so that you´re not dealing with minor details that bog you down is really good. The method that they have for keeping attendance I found very effective. The general managerial aspects of teaching is one thing I would teach. It would be applicable to any teaching course, not just math. I would also devote a lot of time to individual topics, good ways of teaching them, and the types of errors that could be expected from students. There are some really broad generalizations that can be made and have been made about problem areas, I would teach these. My students would get tips on difficulty areas, things to emphasize, and ways that you have to present things for efficiency. Student teachers don´t know these things and they don´t know them until they try them. But to have experienced teachers come in and come up with these suggestions, whether informally or in a structured session, would be helpful. It would take a lot of work on the part of the teacher and whoever is setting up the course to find these ideas and suggestions, but I´m convinced that somewhere there must be some general store of knowledge which math teachers have. There must be some way to compile all of these things and write a book on it. This is the kind of material student teachers should have access to, and we don´t. We are told that we´ll learn as we gain experience, but until that happens we will continue to screw-up these students. You´re not doing as good a job teaching as you could be doing simply because you do not know what problems the kids have, and you don´t know what a good way to teach is.

I am also really interested in learning more about teacher effectiveness training. It worked great for him, and to the extent that I was able to emulate his methods, it really worked for me too. As student teachers, we´re not given any directions on how to control the classroom. How do you know when to kick a student out? How do you know when to do what with these kids? These are the questions that we would like to have answered. Even giving the student a list of possible responses for student misbehavior would be helpful. It could include verbal reprimands, moving a desk, kicking the student out, have the kid stay after class, taking him out into the hall and talking to him. There have been several things I have tried and some have worked and some haven´t. I don´t know where I pull these things from. Sometimes its just suggestions, sometimes its something I´ve heard or remember my teachers doing, and none of it is coming from my courses. Here I am in a faculty that is supposed to be teaching me to become a teacher and I get my ideas about how to handle classroom situations from everywhere but the faculty. Of the three topics I´ve given you, only one relates specifically to math. But I think there are many skills that are not related to the subject area, and these are very important for all teachers. This is how I perceive teaching right now. Teaching is one broad category and it is divided into specialties. But, you are not going to teach a math teacher to handle discipline problems differently than you would teach a french teacher. The same goes for questioning techniques. I don´t see an awful lot of need for the break down here.

INTERVIEWER: [20] What do you think the job the senior high mathematics teacher is?

ANNE: My first thought is to teach math. With what little teaching I've done, the classes that I have the best feelings towards are the ones that I developed a relationship with. I get to know these students, and they get to know me. There is some give and take in this. There is not a teacher-pupil relationship, but a person-person relationship, and I think any teacher should have that. It is not an easy thing to develop and I think it is particularly difficult to develop for a student teacher. Here you are entering into a classroom, displacing the teacher, coming in part way through the year, you're only there for such a short time, you're already concerned about a hundred different topics, you're not worried about developing rapport with this group of kids, that could matter less. But I think it is something which is important. I found I do my best teaching in those classrooms where I have rapport with the kids. The students learn better there, and they perform better.

INTERVIEWER: Please summarize in a short statement what the job of the senior high mathematics teacher is.

ANNE: I'm still stumbling over the fact that this question says specifically senior high mathematics teacher. What is the job of a teacher, not just a senior high mathematics teacher? The job of a teacher is to help these students grow up, to prepare them for learning. They will be learning every day of their lives, and how well you learn and what you learn and how effective you are in your daily experiences is part of what you took away from high school. I think every teacher plays a part in that. The teachers that give you an attitude which is negative toward a subject or negative toward learning, but the teachers that help you be curious, confident, successful and interested are the teachers who are doing their job. Perhaps the job is to foster an interest in learning.

INTERVIEWER: [21] When things go wrong in the classroom, whose fault is it? How about the good things?

ANNE: Mine. To the minor extent that it is the students' fault, maybe 2% out of 100%. Where blame can be laid, 98% of the time its my fault. The same for when good things happen, its 98% my responsibility. The teacher should not rely on the students for excusing their teaching. I think the teacher is responsible for almost all of both.

INTERVIEWER: I find this interesting because in my preliminary data I´ve found out that student teachers tend to take the blame when bad things happen but tend to at least share the credit when good things happen.

ANNE: I think that shows how confident we really are approaching the teaching situation. It reflects how confident you are and your level of self-esteem. If you feel good about yourself, when things go well you think "Hey, I´m doing a good job!" If things go bad you think "That´s too bad, but I´m still alright". To have a positive self esteem is something I think is difficult to find. Its interesting, I can see where that comes from. Student teachers won´t accept the responsibility for good things that they do. I find myself doing the same thing, but you have to give yourself a break and give yourself credit where credit is due. If you´re willing to take the blame for what goes wrong, take responsibility for what goes right. I think you are responsible for both.

INTERVIEWER: [22] What emotions, if any, is it common for a student teacher to feel while student teaching?

ANNE: Fear. Anxiety. Worry. Stress. The emotions you feel are very negative ones. Even in my experiences that go well.

INTERVIEWER: What do you mean by that?

ANNE: I approached my first round of student teaching with absolute terror. This was the first time I had been teaching, I hadn´t even been thinking about teaching for three or four months. And here I am being thrown in front of a class. I was frightened to death. It went great and I had a great time with these kids, and I learned a lot and had an excellent experience. But throughout the whole thing, even part way through, I was still frightened to death. Afterwards, approaching my next round, even though I had this great experience behind me, I experienced fear again. It was a whole new situation, a new set of rules, another school to get used to, another cooperating teacher to develop a relationship with. The way that things change from round to round, you´re always sent back to level one. Whatever positive feelings you have toward your student teaching at the end of one round, you´re not very likely to carry that into the next because everything is changed. You have another set of kids in another school. You don´t know your way around the school. You have to get used to the way they do things, their methods, everything. And this cooperating teacher, on whom your future relies, could be someone with whom you have nothing in common and cannot develop a relationship. This cooperating teacher could be one who makes it difficult for you to learn. In my second experience, that was so. My third experience was another good one, but in the meantime, worry, fear, anxiety, pressures. These are very difficult times to get through.

INTERVIEWER: Are there any happy, good emotions?

ANNE: Sometimes after specific incidents and after the whole thing is over. To look back on it and say "That went really well. I´m glad about the way things went and I learned a lot. That was fun!" This is something that happens afterwards and is happening to me now. It also happens after specific teaching incidents when you finally break through to this one kid and he finally understands how to do his work. After this you´re on a high for a while, at least I am.

INTERVIEWER: [23] How do you measure learning in your students?

ANNE: The only time I know when my students have learned anything is when I question them verbally. I don´t think you can tell simply from looking at their written work and homework assignments. Sometimes they just get their answers from the back of the book. I can tell when they are doing a problem up at the board or when I´m questioning them there at their desks. I´ll watch how they solve the problems, see where they go wrong, and from that know how well they have learned. It happens when I watch them do their work.

INTERVIEWER: I ask this question because I have found that student teachers rarely write "It was a good lesson because the students learned something" or that "It was a bad lesson because the students didn´t learn anything". They write instead "It was a good lesson because the students behaved themselves", and "It was a bad lesson because I wasn´t well prepared for it".

ANNE: Here again I think we´re caught up with what is the purpose for student teaching, and what is the reality. The real versus the ideal. I think ideally a lesson is good if students learn and bad if they don´t, what else is teaching? But, pragmatically, when you´re up there in front of the class, what you´re being evaluated on by your cooperating teacher is how well you handle the class, how prepared you are, it has very little to do with how well the students learned. I think we´re developing an attitude which is a reflection of what we are surrounded with. When you go into the round you may be concerned with how well the students learn and how well they do on the exam, but when you come out you have a good or bad evaluation not on the basis of whether or not the kids learned anything.

INTERVIEWER: [25] Most student teachers report Planning and Preparation (by that I mean writing lesson plans and exams) and Discipline as the things that go wrong most often when teaching in the junior high. Do you think that this is reasonable?

ANNE: These were the things that were the most troublesome for me. I think this is true on my own part because I had no practical experience from which to draw skills. I've never had a job where I've had to discipline people before or write lesson plans. I've never had previous experience in this. My courses gave me next to no help in this area so I was going in cold. Questioning and working one-on-one was no problem for me because I've done some tutoring with kids before. I had no trouble with this. I love it and I do it well. Developing exams and worksheets was not a problem for me. But preparing a lesson plan, guaging how much time it takes to present a topic, how to structure a lecture, whether to have free time at the end, and how much time were all things for which I was not prepared. Nothing in my background could prepare me for these. Some of these I didn't even know would come up until I was there. Its hard to look back and ask yourself what kinds of things went wrong for the teachers; its almost impossible to work backwards this way. But where else am I to look? It was really tough because there was so little preparation.

INTERVIEWER: Do you think that these same two areas, Planning and Preparation and Discipline, should cause the most problems in the high school?

ANNE: I found they did. Discipline is less of a problem in the high school and Planning and Preparation is more difficult because of the level at which you teach and the maturity of the students. When they are younger they come up with some really stupid things simply because of their immaturity.

INTERVIEWER: [26] Most student teachers report that Student Acceptance of Teaching Role (that means being seen as a teacher by the students), Teaching Methods (meaning being clear in your discussions and coming up with good examples), and Discipline are the most important for successful student teaching in the junior high. Do you think these things are the most important?

ANNE: Yes I think Student Acceptance of Teaching Role is very important, so are Teaching Methods and Discipline.

INTERVIEWER: Are they also the most important for the senior high?

ANNE: Yes. I don´t think you can get away from it anywhere. The teacher who doesn´t have control in the senior high is not going to be an effective teacher. If the classroom is chaos, the kids aren´t paying attention, if no work is being done, what kind of classroom is that? If the teacher is not considered a teacher by the students, and for the student teacher its more difficult, they are less likely to accept what you tell them. They are not quite sure if you know what you´re talking about. They are going to be a little more skeptical and they are not going to take it seriously. They may not believe you when you tell them a topic is important or that they should make note of something.

INTERVIEWER: You talk about these three things as being prerequisites for something. Prerequisites for what?

ANNE: For effective teaching.

INTERVIEWER: What is effective teaching?

ANNE: According to Dr. Jones, an effective teacher is one whose students perform well on the standardized exams. I don´t know if I quite agree with that definition though.

INTERVIEWER: Give me yours then.

ANNE: I think an effective teacher has a good relationship with the students. The students come to talk to the teacher about other things, and if they do meet with the teacher outside of the classroom or they run into each other in the hall, there is more to the relationship than just this math relationship. I think the effective teacher is one that the students feel comfortable with. If the students are frightened of you or don´t like asking you questions because they´re afraid you´ll put them down, any of those things, I think that is an example of ineffective teaching. If there are students who are shy to ask questions but are willing to do so anyway, then I think you know you have an effective teacher there. The students show that they are interested and concerned about their learning and when they have troubles they are going to ask. You have developed in that student enough of an appreciation that learning is important and that its the teacher´s responsibility to teach me and to get the kid confident enough to come and ask for help. If the students are taking responsibility for their own learning, then you know you have an effective teacher.

INTERVIEWER: [27] Why do you think student teachers concentrate so rarely on learning?

ANNE: We talked about that earlier. It is caused by the other pressures of student teaching.

INTERVIEWER: What do you think could be done to improve this situation?

ANNE: Take of the stress and the worries of the other factors.

INTERVIEWER: And how could that be done?

ANNE: My cooperating teacher actually did something that relieved the stress. She game me her version of a unit plan. At first I wasn´t sure what I should do because this was a required part of our course. It wasn´t much of a plan, but at least it was something to go on. I had that much less to worry about, and I knew what she wanted me to cover, how much time I should spend on each topic, and I didn´t need to worry about the level of detail. I didn´t have to go to her every day to have her check my lesson plans and give me feedback. This was far more efficient. By helping with the preparation to the extent that she did, I could then spend more time worrying about learning the material. My cooperating teacher would also tell me when she thought things went great, and I was particularly lucky here to have such a good cooperating teacher who took some of the pressure off.

INTERVIEWER: [28] Do you think it is reasonable to say that student teachers progress through three stages as they become teachers? Here are the three stages. First is concern for self. In this stage they ask: Am I adequate? Do I know my math? Should I be a teacher? The second stage is concern for classroom. At this stage they ask: Can I discipline kids? Can I present things clearly? Can I motivate my students? Can I manipulate the environment in the classroom? The third and final stage is concern for student learning. In this stage they ask: Did the students actually learn anything? Do you think this is reasonable?

ANNE: I love it! I think it is great! I think that is such an accurate description of me. I think it is such a valid statement in going from the individual case to the larger case and in considering where your teaching is actually going. I feel I have progressed through those stages in the chronological manner you have presented.

INTERVIEWER: Where would you place yourself?

ANNE: Borderline 2 to 3. I´m really hung up on 2, but I know I´m past 1. I think that in every student teaching round you go back to stage one. I don´t think you hang on to the progress that you´ve made. You start off again worried about yourself. Am I going to be adequate in this new situation? Adequate with this cooperating teacher? I think then you move to stage two and worry about another group of students and their necessary teaching methods, and then to student learning.

INTERVIEWER: [29] Do you think certain things are more important to male student teachers than to female student teachers? What things, if any?

ANNE: It would be really interesting it there was, but my first reaction is that no there is not. That would probably be a very general classification probably derived from stereotypes.

INTERVIEWER: Males tend to be more concerned than females about discipline. I think this is because they are more afraid of having discipline problems. Females seem to find being able to be clear in their teaching methods most important.

ANNE: I think its awful that your results would bear out these stereotypes.

INTERVIEWER: [30] What effect has Dr. Jones´ class had on you? How have you changed as a result of his class?

ANNE: I think the material that we were presented made me think carefully about the best ways of presenting material. I think that was the biggest one. I also became interested in teaching teachers. It hadn´t really occurred to me before that this was area where there could be something lacking. Specifically from the other people in the class, I developed some close relationships and friendships. I think its a wonderful thing that you go through the experience with these other people. I think if you went through this experience alone you would be losing a lot. I learned an awful lot in reflection with others. The callbacks weren´t particularly effective for discussions, but when I got together with others afterwards, I found this very helpful. Because you share the same experiences, you can learn a lot from your peers when you talk with them.

INTERVIEWER: [31] What effect has your cooperating teacher had on you? In what way have you changed as a result of spending time with them?

ANNE: The first teacher helped me have fun while teaching. He showed me that teaching can be fun when I was approaching it with such anxiety. The thought that this could be enjoyable was foreign to me. He also introduced me to the concept of teacher effectiveness. I want to learn more about it. He also showed me specialized methods of discipline. Rolling with the punches is probably the way to put it. He showed me how to deal with things as they come. It was mostly his personal attitude rather than his teaching style. My second cooperating teacher made me realize how lucky I was with the first. He made me realize how important the relationship is with this mentor figure. How important that is to the whole round. I swear I could not get much out of that round simply because we couldn´t get along. He sensed it too. He gave me the negative side of teaching. My last teacher was such a good experience. She gave me some excellent, practical, workable ideas about how to organize my classroom. These ideas are so useful. She also showed me how to be more easy going with the students without diminishing any of my teaching role. She wasn´t a buddy or pal to them, but she could approach them at their level and I had had some trouble with that. I learned you can maintain your own personality and yet can approach the difficult children. I don´t know if I can, but it was interesting to know that she did it.

APPENDIX E
Interview with Dr. Jones

April 24.

INTERVIEWER: What I´d like to do is to go through the content that you set out for the course and have you describe each of the major topics, give some detail about what it was that you taught. I´d like a comment on why you selected these particular topics; why they´d be of benefit to the student; what way you sequenced them; and then, perhaps, some comment on the way these topics were related to the students´ field work, what way you think it might have carried over into their work in the schools.

DR. JONES: There are two separate courses, 364 and 365, and they are parallel courses. The first part of the morning was devoted to the study of the content areas in mathematics. Then, after the break, we looked at what I call pedagogical considerations. In the 364 course, the content that we looked at were the sets of whole numbers, rationals, ratio and proportions, integers, graphing, and so on, with algebra and geometry receiving the greatest emphasis. In each of those areas my intent was not to give the curricular dimensions of these strands. That is, I assumed that each school develops its own programs for whatever reasons, so that the main focus is instructional considerations or pedagogical considerations. In every case we went over different approaches to teaching and different ideas that can be used in teaching, some emphasis on terminology that they might not be familiar with (and there´s quite a bit of terminology in some of these chapters, the pros and cons of using different terminology) and just to alert them to the fact that there might be different kinds of terminology that they will come up against. So, I don´t think for the content strands there was anything unusual. It´s just what I think are fairly sensible ways of dealing with this content.

One of the concepts that I use for dealing with the content is the notion of strategies. We defined strategies as one of the pedagogical considerations, and in the course, we have the five strategies - there´s the algorithmic strategy which just means use the rules; there´s the pattern strategy in which you can show how a concept develops by relating it to a pattern of development; the third strategy is the mathematical model which is a concrete representation of a concept; and the fourth model is mathematical justification where the real basis of knowledge comes from, but we just treat it as another way of talking about mathematics; and then the final one, which is the least well-defined, is the meaning strategy - often our concepts are defined in terms of other concepts, so it´s just a matter of giving a new concept meaning through the elaboration of other concepts. Those five strategies, then, we dealt with under each of these topic strands.

Now, I realize that there´s a real danger with this in that it´s quite theoretical. But, one thing it does is provide alternatives when teaching integers. You can say, "Well, I´m going to show them the product of two negatives," or if you´re doing the graphing or the measurement, "Should I prove this to the kids based on some previous knowledge that they´ve had, or should I pull out a model, or should I use a pattern strategy?"

One of the things that I was quite successful with in this particular offering of the course was in really laying out strategies very clearly. We used them all the time. In almost every case in the junior high school I brought a model in for the whole numbers or rational numbers or decimal numbers or ratios and proportions. One of the conclusions we come up with is that the problem with using a model is that you have to use it enough so that it has some benefit. If you just say, "Well, obviously you can use red and blue chips to talk about integers," you´ve missed the whole point. You have to develop a language around the model.

One of the things we talked about in using these strategies is that a strategy often means developing a language for talking about something that you can´t really talk about. You have to develop a whole set of language around the chips notions. So, that´s really the role of the model, but the important part about all of these things, the way I teach it is, that we have all these different ways of talking about mathematics.

Now, it´s up to you depending on what co-operating teacher you´re with or what teaching situation you are in, to decide what you are going to use. These are sophistocated ways of teaching, and you shouldn´t go into the classroom and bring in some grandiose model and sort of lay it on the kids. That´s being very naive. But, can you bring it in and use it effectively in some minor way so that it adds meaning to the topic? I think this is very important that we don´t treat our junior high school classes in a naive way. You have to be very subtle about how you bring these teaching concepts and teaching strategies into the classroom. I made a big point of that. So, in one sense, this is a very theoretical treatment. It´s not a very hard-nose treatment about how to teach mathematics. In fact, I could probably be faulted on that point. One of the things I´ve said maybe a hundred times in this course, until you´ve built up a trusting relationship with your students, you really can´t do anything other than teach them rules - to use the safest method of all, until you´ve developed their confidence - because once you depart from the "How do you do this? What is the rule for doing this problem?" the students really won´t accept your other ways of looking at mathematics. So, I´ve really tried to push that. The initial part of the pedagogical considerations are these strategies, and then we apply these strategies throughout the content. So, that´s the first half - how we dealt with the content.

Now, in the second half, besides the strategies, I have what amounts to fifteen different lectures in this particular course, and the strategies and understanding is the basis of all mathematics learning (or at least that´s my interpretation of what mathematics learning is). They form three out of the fifteen topics. That´s the starting point from which we operate. That´s really what our goal is. And in many cases, teachers don´t really have that goal. Their goal is to just prepare students to answer test questions. So, we may be being a bit unrealistic in approaching it that way.

We spend time on lesson planning, and in the lesson planning phase, what I offer them is one very fancy model for lesson planning. We talk about it thoroughly. It´s a model that has about fifteen or twenty categories. This opens up the many possibilities in lesson planning. One of the afternoon activities that they have is to use this model to develop a lesson using these multiple categories. But, again, I don´t take a hard-nosed approach. I say, "I don´t expect you to use this in your student teaching. You can use whatever lesson planning devices you would like, but you certainly must be aware that these are the possibilities." So, it´s a theoretical approach to lesson planning, but it is the basis of a couple of afternoon activities. They´re not formally part of the 364 course. It´s part of what we call the afternoon, on-campus practicum. So, it´s a serious attempt to get them to think about lesson-planning.

Another topic that we deal with besides understanding, strategies and lesson planning, is media. There, I have a list of seventeen different media devices they can use, and I have the devices categorized into four or five different categories. One of them, for example, is the blackboard and then notebooks and textbooks. We have film; we have the overhead. So, it´s a discussion of media. So, I think that the media lecture is mainly talking about the blackboard, the overhead, and building physical models that they might use. One of the assignments is a media assignment, because I think the overhead has a substantial role to play in the teaching of mathematics and I think the blackboard has an incredible role to play in the teaching of mathematics. So, those two devices we must understand thoroughly.

Actually, one of the things this brings to mind now, in the second course, 365, we use exactly the same format with the content being dealt with in the morning and then these pedagogical considerations being dealt with in the afternoon. Basically, the pedagogical considerations are identical to those in the first course, it´s just that we go into them in greater detail and emphasize different things. One of the things I do in the second course is, when we´re talking about these same pedagogical considerations, I try to use some of the experience they´ve had in the first round to say "Now what have you learned about using the blackboard, or about using the overhead, or about using a notebook, or about using the text? What are the different ways you can use the text?," and so on. So, in our media lecture in the second part I ask them to contribute more of their ideas. I think this is really the first time I´ve ever done that so intentionally, to have the topics repeated, and used their knowledge in the approach.

Another section is a section on technology (which is calculators and computers), and we just illustrated a few ideas. I really down-played the computer in this course; it´s just not very important. I don´t think it´s going to show up in their student teaching, and I´ve tried to make this as practical as I can to student teaching. I really think that the calculator has a lot of uses. So, we just spend one very short session on the calculator and the computer.

Another thing we talk about is skills, drill, and remediation. We have a section on this because the emphasis is so much on drill in the junior high school classroom. Again, it´s a a theoretical proposition: "Under what conditions is practice the most effective?" I´m afraid it´s a little bit theoretical, but it´s a good question to ask. What kinds of kids really do benefit from lots of practice, and what kind of practice is the best practice? I´m very big on people knowing why they´re practicing and trying to realize what they´re getting out of the practice. It´s only very bright kids that know that, so it ends up that the only kids that benefit from the practice are kids that can bring some sense of purpose to it. So, we just talk about the conditions for practice, and how much understanding you have to bring to a practice situation before you can benefit from it. I realize that drill and practice is a very important aspect of mathematics teaching. Also, what are the best conditions for practicing, and how can you get better at something besides by doing hundreds of examples with it? We´ve talked about using mnemonic devices for remembering.

Another topic is applications and the role of applications, sort of theoretically. I guess this is part of the content analysis. As we´re dealing with geometry we ask "What are the applications of geometry?" But, this section that we have in the pedagogical considerations is kind of setting the stage for "Why do we want applications?" and so on. In that part I tried to go beyond the idea that applications are useful just for motivational purposes. I tried to present applications as a way to learn mathematics.

Another big section is unit planning. I´m very big on unit planning. One of my theories is that education is continuity. It does not occur in a forty-minute lesson. Continuity is how that forty-minute lesson ties into the two or three on either side of it, or maybe even larger than that. In their readings there is an outline of how to prepare the ideal unit plan, which they all read. They prepare a unit plan in both the junior high and the senior high school. It´s an eight page assignment, and they try to think about the various components of lesson planning. I hope it´s useful. It seems to me to be a useful format, but it´s partly that I just think they should do some extensive thinking about how lessons fit into each other and this develops the whole notion of continutity.

We have one session on school observation and supervision. That´s a discussion of when they go out to observe their cooperating teacher, (which they do one day to get some information). That´s a discussion of what kinds of observations they can make while they´re out there. One of the things that I stress in the school observation and supervision is to what extent should you be expected to model your cooperating teacher´s style. And I´m very big on modelling, partly because I think it´s inevitable, and partly because I think it´s a good way of learning. I recall one student teacher´s story. Even when she really didn´t like what her teacher did, after a couple of weeks she found that she was really learning a lot from it. I point this out to students intentionally because of what I´ve seen the students doing over the years, coming back and saying, "I can´t learn anything from that teacher. We´re just totally different personalities. Forget it. I´m going there. I´m rotely putting in my days, but I can´t learn anything." I´m very big on what purpose you bring to teaching. If you do all your student teaching while thinking you´re not learning anything from this teacher, well, I think you´re going to learn a lot less than if you decided to say, "This is a totally different scene, I´m going to learn something about what this teacher does in this format, and I can learn."

One of the big sentences we discuss is: Are we victims of our own personality when it comes to teaching? A lot of them are very big on "Well, that´s not my style. I´m this kind of person." I like the expression: Are you a victim of your own personality? I don´t think we have to be. In some ways teachers are like doctors. There are just certain techniques and certain goals and certain kinds of skills that we must be able to acheive or demonstrate or use regardless of our personality. I think student teachers are really prone to think that they are unique, that they have their own unique style. It´s really a lovely session. It tends again to be theoretical in that it makes interesting theory and nice discussion although its a very down-to-earth topic. You´re going to be spending three weeks with this teacher, so you´d better darn well start thinking about what your relationship is to this teacher and how you can learn from the teacher. What does it mean to learn from another teacher? It´s a practical topic in that sense, but it´s dealt with kind of theoretically, I think.

Another thing we did in one of the sessions was we invited Frank Gibson, who is an Australian educator, to talk about mathematics, learning, and teaching. It was very interesting and cute, but somewhat theoretical. Again, I thought it was useful because we´re talking about a well-recognized scholar getting down-to-earth about what is important in mathematics teaching. He actually talked about the relationship between achievement, proficiency, and understanding. That is, being able to do mathematics, being able to do it without thinking, and understanding why the thing works - those three components.

I taught a session on discovery teaching. I used to do much more work on discovery teaching and the open approaches to teaching. I don´t do that anymore. I don´t think it´s the first level of teaching, for student teachers. My focus now is more on content. My focus is understanding and content, as opposed to processes.

Classroom Factors. What we dealt with there included: discipline; things to consider in the classroom; problems with taking up mathematics homework; how important homework is, and how, in a sense, if the kids know that the homework has to be done, and they´ve worked during the work period in the previous class. These were practical classroom factors. This is probably the only management session that we engaged in. Classroom factors include why we assign homework, and how we take it up, what punishment we give for incomplete homework, what, in general, is discipline in mathematics classes, and so on. We also talked about the general purposes of questioning. One other thing I talked about here is: Who do you ask questions of? One of the things I like to shock them with is the star system, of just focusing on five kids and going for it. In fact, a lot of research shows that that´s the best way to teach. A lot of kids learn by listening. They basically aren´t respondants; they aren´t outgoing. The function of a class is the interaction. You should get the most efficient interaction. I guess that the big thing that I push in these things is efficiency. I give them the Missouri outline for how to teach; its a very efficient model.

The other topic, then, is evaluation. We spent two sessions on that, looking at typical multiple choice tests. I certainly don´t push multiple choice, because in the classroom, that´s a very small part of evaluation. One of the assignments is based on evaluation, constructing an understanding and an achievements test, giving understanding questions and getting a whole range of dimensions in the evaluation.

INTERVIEWER: How did you select the assignments they would complete?

DR. JONES: Well, I have one based on strategies, one on media, one on a unit plan, and one on understanding and achievement. These are all things that they can do in the classroom, in their student teaching. The unit plan is definitely one that belongs to their student teaching. The media presentation is just something that you would actually use, either an overhead presentation or using some other media in a classroom. This last one is one that is done in the context of their practicum. While they're out there, they give an understanding and achievement test. So, I guess, really my assignments are chosen to illustrate some of the more important messages in the course. That's the strategies, media, the unit planning, and then this understanding and achievement testing.

INTERVIEWER: Tell me a little about the EdCI 365 course.

DR. JONES: The only new topic in this course was inquiry teaching, or discovery teaching. Oh, the other thing that we didn't talk about was problem-solving in the junior high school round, though we did have a couple of sessions on it in the senior high school round. So, those basically are the topics for the second course. The format was: we only spent one day on strategies because we spent two or three days on them in the previous course. So, it was basically a repeat, not a lot of material. There were a lot of new examples, especially in terms of the senior high school program. We brought up the fundamental issues, or the fundamental pedagogical considerations if you're going to be a mathematics teacher.

In previous years, I've covered the topics thoroughly here, and then saved three or four topics to cover more thoroughly in the second half. But this year I decided to do everything once, and then repeat them. The other big change I made this year was (because of the very bright class I've had this year) at the end of the first course, I said to a student, "You had a nice idea in your assignment. Why don't you talk to the class about it." So, he spent ten minutes talking to the class about it, and the response was just so wonderful that I thought, "I'm going to insist that everybody participate in a small way in this next course." So then, the student teachers prepared a 10 or 15 minute presentation of something in connection with one of our topics. For example, one of them would have an application of statistics for the statistics session, or they could illustrate a model for this or an interesting problem, a hard, typical kind of ´trick´ problem that you´re going to have to deal with, and so on. I´m very interested in the idea of using their knowledge; they have more time to come up with interesting examples than I do.

I think the key to using their ideas effectively is continuity. There´s no point in one guy presenting for a half hour on just something way out. It has to fit right into the lesson, and I have to be prepared so I can come afterwards and say, "What Tony has been doing is interesting, but the way I think it should fit in is this..." I must definitely leave time for myself to provide continuity to the guy´s message. I think it´s a big error to use large chunks of students´ contributions, because you lose the continuity of a lot of excellent ideas if you don´t tie them together. I really tried to do that, and I think, in general, it contributed terrifically to the course. So then, the second course became much more a course of students participating. I think, not only do they have time to come up with some of the more interesting applications and models and teaching ideas, it lends a certain credibility to the idea. That´s one of the reasons I try to use it more, and it´s something I´m going to continue to use.

There´s very little discussion because there were thirty-two kids in a small room. I decided I would give two lectures and make it efficient and make the time shorter, but it´s very important to get student participation, student involvement. You know, using what they know. They know a lot about teaching mathematics. In fact, some of them are better teachers than I am, and I happily admit that. We have to get them contributing in a significant way in the classroom, and I don´t think it comes through discussion. The instruction has to be a lot more hard-nosed than that, and I think one of the ways is to insist on these little presentations; they can make their contribution in that way. It´s involvement and it´s also a chance for them to test their own ideas out. I encourage them to come with ideas which they thought were useful.

The assignments here were basically the same assignments. They were modified slightly, but there was a media assignment, the strategy assignment, and then an applications assignment instead of the evaluation assignment. I had them do an applications assignment because there are a lot of interesting applications in trigs and logs and statistics. A lot of the senior high school content has interesting applications. And again, the unit plan was done in both courses, because I think its very important. So, in a sense, the 365 was really a repeat of 364, but just done at a different level, using different examples, and so on. But even in that content coverage, we don´t talk about mathematics. Take the Law of Cosines for example. Why does the law make sense? What can you relate it to? You can relate it very nicely to the Pythagorean theorem. This is the type of discussion that we had in these classes. So, we maybe don´t spend quite enough time on the actual mathematics. And in the geometry, I mean, we don´t go through any of the geometric proofs. We talk about the value of the proof and how much it should be emphasized and what are standard formats that we can use for proofs, and we go through the development. Although there is talk about mathematics topics, it´s not directly mathematics, and I know a lot of these kids are in Mathematics 30 and 31 and there´s heavy mathematics there and they do not have the preparation for it and they do not get it from this course. So, a lot of them out there are just swamped with the mathematics. And I think that should be emphasized more in this program. We spent half of our time talking about mathematics. You can´t deny that. It´s just the way we talk about it, it´s not the focus itself.

INTERVIEWER: Of what benefit do you think the above topics were for the students?

DR. JONES: Well, I think that the topics have to be helping them in their student teaching. That´s my focus, but I will admit that they´re theoretical. The things we talked about were just ways of conceptualizing mathematics and the teaching of mathematics. It´s not of direct benefit. There´s lots of lesson planning and unit planning and actual development of media, but it´s a small amount. I really think that I have to admit, even the pedagogical considerations are dealt with at a theoretical level. Even the mathematics isn´t mathematics. The most direct way of dealing with the mathematics, and what the teachers would like most and what the student teachers would like too, is just to go through all the mathematics, prove everything, and make sure they can solve all the problems - just do it very directly like that. But I resist doing that. I´m trying to generalize - what does teaching mean, and how can we think about teaching? So, there might be a lack of directness (which I should try to build in) but one of the things I tried to do in the afternoon sessions was to have them do very practical, working things that they could actually use. But the question is, can they conceptualize what mathematics teaching is? I´m not talking about the curriculum. I´m just saying, "Whatever you have to teach, can you conceptualize what the job is?" This is very much an instruction course, not a curriculum course. I make a big point of telling them that because they´re always asking, "What should you cover first when you´re teaching this stuff?" And I always say, "Well, any order is possible, but regardless of the order you use, these are the types of things you have to be thinking about."

INTERVIEWER: It´s interesting that you say that, because some of the data that I have received from interviews and from critical incident forms, is that the students want a very technical approach to teaching. What they want from you, are solutions to specific discipline problems as well as specific examples and mathematical problems which can be used to teach specific topics. They want a very technical approach to teaching, and you give them a theoretical approach.

DR. JONES: In my approach to lesson planning, my idea was not to give them one format, but rather to talk about the process of lesson planning and have them engage in some possiblity that they could use, but not one that I would expect them to use. So, I think maybe the lesson planning is a good example of what theoretical means. I mean, it´s not the theory of lesson planning at all, it´s just that it´s a generalized format. But, it´s a very specific format. There are fifteen different slots that you have to fill out. How technical, how detailed can you get? So, it´s a far cry from any psychology, so, it´s not theoretical in that sense. I´m not giving the psychological learning principles upon which mathematics is based. Piaget is not mentioned. We did not mention Piaget in this course. Now, theoretical people would just be horrified. Even practical people would be horrified. So, in that sense, it´s not theoretical, is it?

INTERVIEWER: No, I can see what you´re saying. In that sense it´s not. I think it´s a matter of degree and the students´ expectations. Now keep in mind, that there is a mixture of students in every class. I can think of one student that I interviewed, he just loved everything that you had done. Your course was just right for him. There was the right balance of theory and practicality for him.

DR. JONES: These models that I´m bringing in are not pie in the sky stuff. How can we use coloured chips to talk about integers? That´s very practical. We just plop them down on the table, and we develop the language for talking about it. All of the models could be used very theoretically and naively, but I warned students, "If you´re going to use this model, you have to think about the different ways you can use the model. You can´t just bring a full-blown treatment of a model into your classroom and expect either your cooperating teachers or your students to benefit from it or to appreciate it." So, any of the models that we used, that we talked about, are totally legitimate possibilities.

INTERVIEWER: For student teachers, it might be difficult to define practicality, but theoretical, to them, is anything that doesn´t start with the preface "The right way to do it is..." That´s the kind of feedback that they´ve given me.

DR. JONES: The one psychological principle that we did invoke was metacognition. I´m just interested in that now. But, I tried to bring it in as what the concept of metacognition means for whether you should give notes or not. That´s a very practical consideration, that it is important to give notes, how to give notes, when to use them. That´s not theoretical. I certainly don´t insist that they do this, but metacognition could be a psychological principle that you would bring to bear on some of these classroom issues. That´s the only really theoretical premise.

INTERVIEWER: So, in what specific ways did the topics and discussions relate to the students´ field work?

DR. JONES: The students only find out the location of their junior high placement and the subjects they will be teaching one week prior to the beginning of their student teaching round. This makes it difficult or impossible for them to write up their unit plan assignments such that they may be used in the classroom. The students find out the location of their senior high placement two weeks prior to the beginning date. This makes it possible for them to write up their assignments such that they are useful in the classroom. They will only have three units to teach when they are in the schools, so they will only be able to use three of the units which were covered in class. But, theoretically, the pedagogical considerations could be applied to any unit. You can use media, or strategies, or unit planning.

INTERVIEWER: In what way did you teach them with that bent, that these were things they were going to be using out in the field?

DR. JONES: Well, you mean for the pedagogical considerations?

INTERVIEWER: Yes

DR. JONES: I guess it was done at a theoretical level. If you´re going to be doing skill work and drill work and practice and so on, then these are the things that you have to consider. It isn´t very direct, in fact. I just talked about the computer for one session, and did so in a very theoretical manner. Lengthy sessions on computers would be totally irrelevant. The sessions may be very practical, it´s just that it doesn´t apply to what they are going to be doing. So, my topics are very relevant, it´s just that they may be dealt with at a higher level. But, if you can´t deal with them at a higher level, you can´t cover any of this stuff if you cover it specifically. Anyway, that´s the challenge.

With respect to the media I say: "Listen, you´re going to have to use the overhead. I want you to prepare five overheads on some topic and show how they can be used effectively in teaching. How would you build that into a course?" This is direct. That´s just one example of what they work on. And, the strategies assignment is to develop one fully developed strategy for teaching a topic. You pick one strategy and then you work it up into a lesson plan. Theoretically, they could use it, but I don´t think there is anything I do that says, "This is the way you teach."

There´s a lot of variety and different ways of doing things, and I´m very big on efficiency. The last two or three days I´ve been observing student teachers. One of my student teachers is very efficient. She just covers a lot of work. I admire that. She´s very hard driving. We talked about that. We talked about the star system, how it´s an efficient system of questionning. You get a lot of ground covered, and that is the scene in a sense. We talked about it theoretically. That´s what the Missouri group is advocating. Just get in there and do the job in the most efficient way, the most ruthless way possible and get the hell out. But, we only talk about that as a theoretical possibility, not as a way of doing it. I partly believe that there is some merit to a variety of teaching approaches. The hardest line I take is the unit planning. I say, "You have to use my format. You have to cover these topics. I don´t care what you use when you get out in the school. That´s your decision, but for this assignment, these are the eight different things you have to comment on in the unit plan." I certainly don´t expect them to develop unit plans in that way in the school setting, and I tell them that. If they find that appropriate, however, they can use it. Anyway, I think there are two things: pedagogical considerations are dealt with at a general level; the content is dealt with at a somewhat specific level, but not a curriculum level. I´m not talking about the curriculum. The trouble there is any kid will only be using twenty-five percent of that content. Once we hear what they´re going to be teaching, then really it could be structured so that you let them work on those units in little cells. We do a bit of that in the afternoons when they´re doing lesson plans and such. So, that´s quite specific.

INTERVIEWER: Let´s move on to discuss the afternoon sessions, their organizational structure. There were several afternoon components that were involved in your course. How did they link to the morning sessions, the basic portion of the course, and in what way did they link to the field experience?

DR. JONES: They were all student-oriented, student work, and varied discussions, applications of what we were doing in the morning and what they would be doing in their schools. There was lesson planning and talking about unit planning and, we had one afternoon of computer illustrations where some kids just brought in actual software that could be used in the classroom. In both cases, we used one of the sessions for a sort of debriefing in the junior high school round. So, that´s very specific - "What were your experiences in the junior high school teaching, and what do you think you can bring from that experience to the senior high school teaching?"

I think that all of the afternoon sessions were very directly related to them doing things that they would be doing when they were out in the schools. Even if the lesson plans weren´t very practical, and the unit plans weren´t very practical. That was the intent of them, that they should be very practical. Again, there were students doing things that they thought would be important, and things that they thought other kids in the small group of six would see as important. It was their chance to do something for their colleagues, something that their colleagues would benefit from. There was no outside criteria, no hoop-jumping that they had to go through. Anything was permissable, and just what they thought would be sensible. It´s one way of letting them decide what is going to be practical. I guess, if they´re really not capable of that, then it´s not a good thing to give them that decision, because they don´t know what´s practical. They think that these things are practical, but they may not be. The intent was to let them have some say in what is practical.

INTERVIEWER: So that was your intent in including them in the original design of your course?

DR. JONES: Yes, it´s called an on-campus practicum, this 354, the on-campus practicum. The callbacks are part of that on-campus practicum. They make up about forty hours and it´s supposed to be things that you don´t have time for in a methods class, that are very practical kinds of things that you can teach. It´s a chance for the faculty consultants to get to know them. In that sense it´s a direct benefit for those people involved in the practicum. I know the kids really enjoyed working with the faculty consultants. They got to know them, and I´m sure it was of extreme benefit. Especially compared to a lot of kids in these integrated programs who don´t even see their faculty consultant before they go out.

INTERVIEWER: You said that these afternoon sessions were of extreme benefit to the students. Can you list some ways in which they were?

DR. JONES: The topics were all things that they would have to consider when they were teaching in their units. In the last week, for example, of the first round and the last two weeks of the second round, they were focussing on content that they were going to be teaching. In fact, one of the things was called, "Workshop on a Unit Plan." That was just them getting together in groups and coming up with media applications, problem solving exercises, for the particular units that they were going to be teaching. So, at least half of the sessions were spent on actual materials that they were getting ready.

INTERVIEWER: How would you describe this class of students?

DR. JONES: It´s the best class I´ve ever had. Honestly, I think that. And in the end, I think teaching is all about having something to say and being bright and that kind of thing. You can learn communication skills as you go along. I can teach people that, but I can´t teach them to have brains about mathematics. That´s my theory. There is just a lot of potential there. Ten of them were extremely good students, but the range was just incredible. There were six or eight very, very poor students. One of the things that happened in this course was that there was a lot of intimidation. Three or four kids spoke out, dominated the class, and it´s very hard to control that kind of thing. So, I do think the kids at the lower end of the scale were intimidated. In fact, maybe fifty percent of them were intimidated by other students. I´m not wanting to be too pessimistic about this, but there certainly was that element there. There were a few kids who just, through sheer force of personality, could hold their own. They were the exceptions in the class. It is because I thought so highly of the students that I decided to have them participate in this second course (the 365). I said, "We have got to use these Bobs and Janices. We´ve got to use these guys´ ideas. They have some wonderful ideas, and wonderful convictions and attitudes about what the heck teaching mathematics is." It is good to get Bob´s views on the table. Then, I treated that as a forum for me to analyze. But, his ideas were the stimulus, and then we conducted the class based on that. I´d follow it up and try to tie it in. But, it was because they were operating at such a high level that I wanted to do that.

INTERVIEWER: I´m going to ask you how you would compare this group to past classes - more their traits and the characteristics - and how these traits might contribute to them reporting exceptional incidences or reporting things out of the norm.

DR. JONES: I would say they were very typical. I was very pleased with the class. I thought I achieved what I set out to achieve with them, and I got no feedback to the contrary, that we weren´t doing something that was quite relevant. In that sense, it was a more agreeable class, a more cooperative class than other classes. In the end, I would say that I felt that I achieved what I was trying to achieve.

INTERVIEWER: And in many respects, the students that you had in this class were similar to those you have had in past classes?

DR. JONES: Yes, but better. Maybe even more cooperative, less challenging in the ultimate sense. Maybe that´s because with thirty-two you just don´t get the interaction that you would get with other classes. I felt satisfied that we´d actually done something, that I actually had made a difference to these people.

INTERVIEWER: Looking back on the course, how would you change it and why?

DR. JONES: One of the things I´m dissatisfied with is I spent a lot of effort getting placements for these kids for their rounds, and now I´ve lost sight of them totally. I have no connection with them. That makes the course less practicum-related. I just give my shot and they go out and that´s it, and you forget about them. I´ve got lots of papers to write, research to do, and all sorts of things to do, and I want to forget about them. And this course is designed perfectly for me to forget about them. I think having a two-week session at the end of this study would add incredibly to this course. It would really tie in the course to the practicum. It would force that tie in. Actually, I think a lot of the theoretical stuff I do should be done then.

INTERVIEWER: May I follow that up? I´ve discovered that the theoretical concepts are being presented to the student teachers at the wrong time, before they are ready for it. They´re so tuned in to getting fives that the theory escapes them. They can´t even remember the theory because it´s not practical or straight forward enough for them. Would that tie into what you are saying here?

DR. JONES: Oh yes, I think so. The worst concern I have now is my own feeling of not caring about these kids. Somebody just phoned up now about this student teacher. I don´t care about Shirley. She´s gone. I´ve had it. That´s not where my commitment lies, and it´s because the course is structured that way. And that´s a crime. It´s absolutely a crime. I tried to generate some enthusiasm and tried to think back, but Shirley´s grade is decided and it´s all gone. And I think the course is designed that way and that is a big error. I think I would do a lot of things differently in my methods class if I knew that in two weeks time I was going to be held accountable, if Shirley was going to be coming back and say "Listen, I didn´t know any trigonometry when I went out there, and that´s your fault." If I knew that that was coming, I think maybe I would teach a more direct course, and perhaps save this theory for them. Because I´m a great believer in matacognition, I think a lot of our action is based on what we think will happen because of our actions. If there are no consequences, if we won´t have to face our consequences, then we´ll do different things. If you know those consequences are coming, then you´ll structure your work differently. I´ve never really thought of this before, but I´m sure it could make a big difference. I´ve been wondering for two weeks how Joshua is doing and how Raymond is doing, or wondering what is happening to Mark. I´ve spent so much effort finding him this teacher and negotiating with him, and knowing his personality, knowing the kinds of things he was interested in, and then I never heard anything about it again. I don´t even know if he´s happy there. I know he hasn´t complained, but how nice it would be to have some follow-up. Even in the junior high school round we don´t follow-up. We treat this as a separate course. Now we´re coming into Senior High 365. Forget everything you´ve learned.

I can´t see changing the basic structure of this outline. I can´t conceptualize what I would do. I do not have any ideas for how I would do it differently. I´ve modified this over the last twenty years and it´s very different from what I used to do. Part of the structure is based on the fact that this is a three-week course that goes three hours a day, plus two hours in the afternoon involving thirty-two kids. It would probably be quite different if it were spread out over a longer time and then different things could happen. Based on these types of parameters, I feel it has to be structured the way it is.

INTERVIEWER: In general, what do you think the students got out of this course? What do you think they took away with them?

DR. JONES: How to conceptualize the teaching of mathematics.

When they hear anything about the teaching of mathematics, about any kid having trouble, or any teaching assignment that somebody wants to teach a unit on, they will be able to conceptualize the whole operation. What kinds of learning outcomes we should expect, what kinds of things we can engage in, what are the benefits of these types of activities, and so on. I think that's what I've tried to stress in this course. It is one view of teaching mathematics. Understanding, that's really what we're talking about when we're talking about teaching mathematics. That's what teaching means. In terms of this content and in terms of the pedagogical considerations, I hope they've gotten that out of this course.

They've learned a terrific amount about mathematics teaching. And anybody who says they haven't is lying, or living in a totally different space than I am.

INTERVIEWER: How much transfer do you think takes place between their coursework on campus and their student teaching experience? And is this the same for the junior high as it is for the senior high?

DR. JONES: Well, I think that for eight kids out of the thirty-two there would be lots of transfer. My whole course is based on the fact that this knowledge will transfer, but realistically, when they get into the classroom, and these teachers say, "Listen Francis, that's not the way we're going to do it. We are just going to get these six types of examples done, and you're going to give them six questions on each of these examples, and that's going to be it." And Francis says, "Oh, well, I should give some sort of overview about where we're going with this thing, and make this a little more interesting. And I could bring in this little practical example." The teacher says, "No, Francis, this is how we're going to teach this stuff." And then Francis ends up saying, "Well, you know, she's right. Really, I think that is the best thing to do, really go for it." So, I think with a lot of pressure like that, even the ones who would want to use what I teach don't get the chance to make the transfer. She has to make the connection rather theoretically. But for the other three-quarters, they're probably not even interested in making the connection.

INTERVIEWER: Do you see sort of a countering effect between yourself and the cooperating teacher?

DR. JONES: What I say is, "You have to teach the way your cooperating teacher is going to teach, you have to admit that. But, even if you take his lesson plans, you can allude to an application, you can show a model, you can use a pattern, you can explain it involving these patterns. So you have no chance of modifying the overall approach, but all of these things can inform your teaching so that you will be an intelligent teacher." I say that a lot. Forget about really changing anything that your cooperating teacher is doing, but anything we talk about here can be used to make your teaching better, but minimally. So, I see a definite conflict, and I try to admit that conflict and admit that the cooperating teachers have a valuable perspective. The thing I want to avoid when they get confronted by the cooperating teacher is that my perspective doesn't get completely blown away. So, I teach it as this: "You can use this in these different ways. It can influence your teaching." That's how I try to prevent it from losing all credibility. Before, I used to say, "This is how I think it should be taught. You go out there and do the same." Then they just say, "What Jones said is irrelevant." But now they can say, "What would Jones do faced with this same situation?"

INTERVIEWER: This may not be a fair question, but who do you think has the most influence over these student teachers, the faculty consultants, their professor, or the cooperating teacher?

DR. JONES: Well, I think the effect comes in a different way. The cooperating teacher has the most direct effect, but I've given them a conceptualization of teaching mathematics, and that has got to influence the way they think about teaching. I would like to know if it does. They have got to have learned something from viewing the teaching of mathematics this way. We have studied wonderful things, really important things. But, the question is, do they remember them past this experience? That's what I don't know about. It's a large amount of faith on my part that they will remember these things and eventually think back on this kind of thing. But, the most direct effect will be the cooperating teacher's impact. I can't help but think that this course is going to have some impact on them.

I do not have a lot of faith in faculty consultants. I have faith in the process, but in the individuals, I don't. It's hard to have an impact as a faculty consultant. It is very hard to have an impact, because we structure it so that the kids know the faculty consultants so much better. For some reason they like the faculty consultants so much, they don't see them as so much of a threat. I think there's a chance of a comradery between a faculty consultant and a student teacher developing. I really think that has happened. I may be wrong. There probably is a chance for a faculty consultant to make a difference in this thing.

I guess they're all at different levels, and certainly the most important is the cooperating teacher, and then the faculty consultant is kind of a buffer for the cooperating teachers. Any effect I have has to come in as sort of a reflective way.

INTERVIEWER: It´s interesting that you´d put it that way, because one of the people I interviewed said when I asked him, "What was the benefit of this course to you?" that "Right now, nothing. It didn´t help me now, but I don´t know, it might make a big difference in two years." I think he´s talking about his conceptualization of mathematics, a philosophy or the development of a philosophy.

DR. JONES: Well, I hope your study doesn´t mean I have to revise this bloody course all over again.

INTERVIEWER: Well, I´m sure it won´t.

DR. JONES: I have a lot of reasons and rationales for what I teach, and I can see a lot of benefit in this whole thing. I do think that if what that guy is saying is in fact a sincere reflection of a considerable number of people, then this course has to change. They have to see this as having impact now, or else I´ve lost the battle. I can´t go on with the same course if this is true; I know learning doesn´t occur that way. You have to be making a difference now for it to have a long-term effect.

INTERVIEWER: Why is this course taught? Do you think that this goal was achieved?

DR. JONES: As I say, everything in this course can be used in student teaching, and so, it´s to inform the practicum. To make the practicum more beneficial, to help the student teacher to think about the activities he or she is involved in, and to give alternatives in the practicum. Everything we do in this class has to be usable in the practicum.

You have all these possibilities. Some of these things are just harder to employ. I would think that the answer to the question is that all of these things can inform the practicum. If you think these things are irrelevant to the practicum, if there isn´t a chance that you can use any of these ideas, then we shouldn´t be talking about them. So, it´s practical in a conceptual sense. It´s not practical in a hard-nosed sense.

INTERVIEWER: You´ve talked quite a bit about your personal perspective, is there an institutional reason for this course?

DR. JONES: It´s called an integrative program, so it´s a support course for the practicum. The whole theory is that these are the two semesters where we are supporting the practicum. That's the theory behind the course. I think that the biggest tragedy of this course is that it's offered as a crash course in three weeks, and the focus is this very terrific motivation that they bring to this class. Because the motivation is so high, they just want practical things. I like the example: There's two kinds of motivation. If a bull is chasing you, it increases your capacity to jump the fence, but it detracts from your capacity to pick a lock on the fence. I think this kind of motivation increased your capacity to do really practical things, things that are urgent, but to think...it is not a thinking kind of course.

INTERVIEWER: I guess, then, just to summarize, do you feel that these goals are being achieved?

DR. JONES: I have no reason to believe they aren't. I know that the level of motivation of the kids is so high. They want to jump the fence. It really does detract from this ultimate goal. My test shows that they have learned a lot of what we have been talking about, but the impact that it has had through the practicum is not there. I have no evidence to show whether or not it shows up in the practicum. My part in this course is ended once their practicum is begun. Their mark has already been determined. I guess I don't evaluate what effect it's had on the practicum. In some sense, I'm unhappy in the way it's been set up right now. It's too much urgency. The kids are in a different space, and you're trying to get them to be reflective and thoughtful about conceptualizing some of these things, and they just want to know how to do it.

In general, I'm a very pessimistic person. I'm not a believer. But I really think this is living, teaching people how to teach. It's relevant and important and fun to do.

APPENDIX F
Sample Critical Incidents

SUCCESS INCIDENTS:

SENIOR:FEMALE:AFTER:LATE:PLAN & PREP

I am insecure with logarithms and because of this was nervous about teaching it to stuents. This caused me to plan very carefully and teach very clearly so that the students seemed to pick up the concepts very well.

JUNIOR:MALE:AFTER:EARLY:SELF ACC OF TEACH ROLE

Classroom management for all of my classes is improving. I have had to be heavy handed at times to let the class know that I mean business. I ask for silence and if they do not want to learn then don´t disturb your neighbors. Some students just do not care and as my co-operating teacher has said, you cannot force them to learn. They have to have some intrinsic motivation otherwise you are banging your head against the wall when there is no real need to do so. By this grade if they don´t care about school they are a couple years away (or less) to being able to legally drop out of school and most will. Perhaps special practical math classes should be given to show them how to balance a checkbook or figure out interest rates. It would be better for them.

JUNIOR:FEMALE:AFTER:MIDDLE:STU ACC OF TEACH ROLE

The students received their tests back on the previous chapter and were feeling very conscientious. This made for a very attentive class and one stuent, in particular, who I had been having trouble with in terms of attitude, thanked me for helping her with the concept. Previous to this point she had always been critical of my discipline and methods. The chapter test forced the students to take things more seriously.

JUNIOR:FEMALE:AFTER:EARLY:CLASS MANAGE

A successful incident I had in teaching math happened in a double period (1 hour) teaching the comparison of rate, ratio and proportion using the overhead and exercises on the overhead. The first part off the period, 8 girls left my class for 15 minutes but I went on with my lesson and when they came back I had to let them catch up yet keep the others busy. They did an exercise. The others caught up and lesson was completed as planned.

JUNIOR:MALE:AFTER:EARLY:TEACH METHOD

This lesson was successful for a couple of reasons. I used two strategies to present this material. I used a pattern strategy to show how to find the general equation of $V=1/3Bh$ as well as various models to physically show different types of pyramids. The students seemed to relate to the idea that pyramid volumes are a simple extension of prism volumes. By relating known material to new material meaninful learning is more possible.

SENIOR:FEMALE:AFTER:LATE:DISCIPLINE

On this particular day some of the students were absent from class due to a sports event. Since I did not want to get too far ahead when the students had finished their assignment I gave them some algebra to work on so they were given a change of pace. Three of the students decided not to do any of this and made it clear that they thought this was a waste of time. Two of them disrupted and began to annoy the class as much as possible. When there was three minutes left I asked for the class to hand in all the work they had done that day. Those three that had done next to nothing had next to nothing to hand in. I showed this to my cooperating teacher and we confronted the students who were then suspended from the class until all work was complete. By taking the work in as I did, we had the proof of what the students had done or not done in this case. They did not seem to think I would do anything about it but this proved them wrong.

JUNIOR:FEMALE:AFTER:EARLY:WORK ACCOM

After school two students came to get help. One of the students was the student who could not be motivated on the previous Friday. I stayed with the students for about one hour and after the hour each student was able to do 75% of the examples correctly.

SENIOR:MALE:AFTER:LATE:MOTIV STUDENTS

In this class we were reviewing the law of sines and I was doing word problems to show the proper step by step method. I looked for practical examples to show the usefulness of this formula. The first example was on trying to find the height of a tree on a hill. I had a student come up and draw the diagram for the rest of the class. For the second example I asked the class to make up their own problem. They had an idea of finding the height of a ski lift tower. Another student gave me some numbers and then we proceeded to solve it. This helped increase student interest and made them feel more a part of their education. Rather than always getting problems thrown at them they got to make up their own problem. This is obviously a great motivating device.

JUNIOR:MALE:FIRST:EARLY:SENS TO STU LEARNING

I found out that it is important to have a do-now exercise as part of a math lesson. You can do all the examples you want on the blackboard or overhead and students will nod and say yes I understand. However when they try their homework exercises they don´t understand it anymore.

If instead you do some examples on the board, then have the students do some you eliminate this problem. You check for understanding and get the students ready for their assignment.

SENIOR:FEMALE:AFTER:LATE:LEARNING

I felt this class was a success because the students were able to complete the assignment with no difficulty. I had given them a previous assignment which they completed using a computer graphing program (graphing quadratics) and were asked to make conclusions about the graphs and the relationship to each other. In this class I gave a similar written assignment (sketching graphs) and most (all) students had no difficulty with it.

NONSUCCESS INCIDENTS:

SENIOR:FEMALE:AFTER:LATE:PLAN & PREP

While teaching addition and subtraction of polynomials I assumed the students would find the subject very easy. My lesson plan was simple and did not include a lot of examples. I soon faound out I was wrong--this taught me to prepare for the topic as if students would have difficulty. Prepare for the worst, or just be prepared.

JUNIOR:FEMALE:FIRST:MIDDLE:SELF ACC OF TEACH ROLE

This class was a final lesson before an exam to be given next Tuesday (since we had a long weekend due to teacher's convention). Power of a power and power of a product rules were covered for the exam. The problem with this particular class has been that they are all quite able academically and very amiable. Because of this I have generally been quite lenient with respect to discipline. Consequently students are becoming disruptive and even insolent. They are exercising their freedom to the maximum! A lot of class time was wasted by students fooling around.

JUNIOR:FEMALE:FIRST:MIDDLE:STU ACC OF TEACH ROLE

During this particular class, the cooperating teacher decided to leave the room. He had done this before with no problems. He stayed out for the entire class (first time). One girl had been in trouble with another teacher the class before. She got the class going. None of my methods were working. It resulted in a girl being sent to the office and the class being talked to by the principal.

JUNIOR:MALE:AFTER:EARLY:CLASS ENVIRON

Melony was a below average student. While answering questions at the students' desks (Karen and Francis) I missed Melony's hand up and her need to be recognized. Since i missed this, Melony is now quiet and sullen in math class. I must keep control of my vision in the classroom to be able to keep control of students' needs and wants.

SENIOR:MALE:FIRST:MIDDLE:TEACH METHOD

This was the first day I had the Grade 10 class for mathematics. Although I had sat in on their classes for the previous two weeks I had not taught them to date. The first class I spent overviewing the unit on similar triangles and trigonometry. The students generally seemed attentive. I started the lesson explaining how trigonometry is one of the more useful branches of mathematics (engineering, architecture, navigation, travel, etc.). At this point I had the interest of much of the class.

I began to explain the theory behind trigonometry and similar triangles. I did few example problems at this point, since I thought it wise at the time not to just give them an algorithm method for solving these problems. I explained that it was important in trig not to miss steps or information when solving the problems since it made it very difficult to follow the work and often incorrect solutions would result. The students began to attempt the problems with little success. Often they would miss steps or omit information. They refused to draw diagrams or write down the information given. I became somewhat frustrated after the class had finished for the students would not even try to do the problems unless you led them by the hand through the solution.

It was after the class that I realized that the students were frustrated because they did not have a set method by which to solve the problems and their frustration was a result of my not telling them the step by step procedure for solving the problems. In retrospect it may have been a blessing in disguise, for later in the week when I showed them the procedure for solving the problems they understood the concepts much better than I think they would have had they just been given the algorithmic method of solution.

JUNIOR:FEMALE:AFTER:MIDDLE:DISCIPLINE

On this day there was a substitute teacher in the class while I was teaching. This really seemed to make the students act up and I had a hard time getting through the work. It took the whole class to mark one homework assignment. It was just impossible to keep the students on task. They seemed to have to show off or something with an extra person (stranger) in the room.

JUNIOR:FEMALE:AFTER:EARLY:WORK ACCOMP

Each day two pages of homework are given. The 9B's were asked to have three pages done for Monday with two pages being puzzles working with integers and one page using the product property of exponents. I had asked the students to work on the exponent page first (in class on Friday) so if they had problems they could ask. When the homework was corrected about half of the students had not completed all of the work. Some were confused so I reviewed the old work and started with the new work (quotient property). I assigned two pages of work and still some of the students did not want to do it. Examples of the quotient property were given and very few students seemed confused. I thought the lesson was unsuccessful because the students did not do their work.

JUNIOR:FEMALE:AFTER:EARLY:MOTIV STUDENTS

A student could not understand the assigned homework so I explained how to do a couple of the problems using the rules of exponents. After the explanation, he still did not understand so I took a smaller problem to work on. He still did not understand and seemed to be giving up. I suggested to him to come for help after school but he said he would ask another teacher how to do it on the computer. It was unsuccessful because I could not motivate the student and he did not want to learn.

JUNIOR:MALE:FIRST:MIDDLE:SENS TO STU LEARNING

Does review really help? I spent six lessons on exponents, one of which was strictly review. I went over every question they had problems with on their review sheet. I then gave them a test of which 60% of the questions came directly off of the review sheet (I just changed some numbers). My class average was just 43%. I feel like I wasted this lesson reviewing. Maybe I don´t read ´student signals´, such as confusion, very well or maybe they just didn´t study. I however feel I wasted a valuable lesson which in my eyes is unsuccessful.

JUNIOR:MALE:FIRST:MIDDLE:LEARNING

There are certain topics in math that prove to be more difficult to grasp than others. One of them is the use of the distributive, associative and commutative properties in simplifying equations. I taught each of these things to a group of grade eights and during the last period of the week I gave them a test that included the question of what is

$$\left(\frac{25}{2} \times \frac{11}{100}\right) + \left(\frac{25}{2} \times \frac{39}{100}\right)$$

Nobody recognized that a simple way of doing this was

$$\frac{25}{2} \times \left(\frac{11}{100} + \frac{39}{100}\right) = \frac{25}{2} \times \frac{50}{100} = \frac{25}{2} \times \frac{1}{2} = \frac{25}{4} = 6\ 1/4$$

even though half got the right answer by figuring out the individual terms. Because the objective really was to use simpler methods with the above properties I feel that it was indicative of an unsuccessful incident.

APPENDIX G
Course Outlines

Ed. C. I. 364

Winter 1987 Dr. Jones

1. Junior High Curriculum	1. Lesson Planning
2. Strand - goals	2. Understanding
3. Whole numbers	3. Strategies*
4. Rationals- fractions	4. Strategies
5. Rationals- decimals	5. Media**
6. Ratio and Proportion	6. School obs. and supervis.
7. Integers	7. Technology
8. Graphing	8. Skills, drill, remediation
9. Measurement	9. Applications, process
10. School visit - all day	
11. Geometry (motion)	11. Unit Planning***
12. Geometry (constructions)	12. Classroom factors
13. Algebra	13. Inquiry teaching
14. Algebra	14. Evaluation****
15. Exam (2 hours)	

Course Assignments

*1. Strategies(3) for some specified content.(1000 words). (Due day 6)

**2. Develop a mdia presentation. Comment of positive and negative features of this usage.(1000 words) Due day 11)

***3. Unit plan for unit to be taught during student teaching.(10 pages) (Due day 15)

****4. An understanding discussion and an achievement discussion to the same pupils.(6 pages) (Due day 2 of Ed. C.I. 365 or sooner.)

Each assignment is worth 15% of the final mark. Final exam is worth 40%.

Ed. Pr. 354

(This on-campus practicum is graded on a credit-fail basis.)

Afternoon Sessions - 12:30 to 2:30

1. Monday and Tuesday -
    - Week 1 - Classroom basics
    - Week 2 - Problem solving
    - Week 3 - Applications
2. Wednesday and Thurs (Faculty consultants)
    - Week 1 - Lesson Plan (present - explain)
    - Week 2 - Unit Plan (present - explain)
    - Week 3 - Lesson Plan (teach)
3. Callbacks in each round - First Thursday @1:00
    - Third Thursday @1:00

Ed. C. I. 365

Winter 1987 Dr. Jones

1.	Number Systems H4-1 & polynomials H4-2, MI5-2	1.	Senior High Curr. Strands, electives
2.	Factoring and rat. exp. H4-2	2.	Media*
3.	Exponents and rads. MI5-3, 6-5	3.	Lesson Dev., skill, drill
4.	Ratio, prop., variations MI5-5	4.	Strategies**
5.	School visit - all day		
6.	Geometry Math 10	6.	Unit planning**** Textbook use
7.	Geometry Math 20	7.	Applications***
8.	Coordinate geometry	8.	Problem solving
9.	Trigonometry	9.	(Follow up)
10.	Statistics	10.	Technology
11.	Logarithms,exponentials	11.	Evaluation, purpose
12.	Sequences and Series	12.	Evaluation, items
13.	Systems of Equations	13.	Inquiry teaching
14.	Conics	14.	Student teaching
15.	Exam (2 hours)		

Course Assignments

*1. Illustrate the use of media (not done in 364) for ONE senior high school mathematics topic.(1000 wds.) (Due day 6)

**2. Prepare a FULLY-DEVELOPED strategy or model for the teaching of some content.(1000 wds.) (Due day 9)

***3. Develop an applications approach to a unit of your choice.(1000 wds.) (Due day 11)

****4. Unit plan for a unit to be taught during student teaching.(8 pages) (Due day 15)

Each assignment is worth 15% of the final mark. Final exam is worth 40%.

Ed. Pr. 354 - graded on a credit fail basis

Afternoon Sessions -

1. Monday and Tuesday
   - Week 1 - Junior High Debriefing
   - Week 2 - Computer illustrations
   - Week 3 - Workshop (media, applications)
2. Wednesday and Thurs (Faculty Consultants)
   - Week 1 - Unit Plan (discuss) - curriculum guide
   - Week 2 - Lesson Plan (discuss) based on practicum situation
3. Callbacks in each round - First Thursday @1:00
   Third Thursday @1:00